The Journal of ENGINEERING EDUCATION

November, 1957 ***Table of Contents*** **Vol. 48, No. 2**

Do You Know 67

The Revised Constitution — W. Leighton Collins 69

65th Annual Meeting, Part II

Research and Engineering Education — Eric A. Walker 70

Basic Considerations in Salary Administration — M. R. Lohmann 81

Upright Students—Upright Engineers — Paul R. Robbins 85

What the Technical Teacher Can Do To Improve Training in Writing Skills — Christian K. Arnold 90

What's Base in a Basic Curriculum? — Robert L. Zetler 96

Articles

Educational Use of Nuclear Reactors — Charles F. Bonilla 102

Teaching as an Exciting Career — M. Stanley Helm 111

Committees and Officers, 1957-1958

Society Committees 115

Officers of Divisions 118

Officers of Sections 121

Minutes

The Executive Board Meetings 123

Appendix "B": Committee on Professional Climate of the RWI Division 129

Appendix "C": Resolution on Proposal of EJC–ECPD Joint Committee 134

The General Council Meetings 135

Appendix "L": YET Summer Institute Committee 143

Appendix "M": Technical Institute Education Committee 143

Appendix "O": Resolution of ERC Executive Committee 145

Appendix "P": Committee on Resolutions 145

Departments

New Members 147

Teaching Positions Available 152

YET-itudes: A Year of Challenge — Harold A. Foecke 153

Graphics Science: Research in Graphics — Steven Anson Coons 157

Copyright © 1957, The American Society for Engineering Education

Notes

Harry Stanley Rogers	80	EJC Third General Assembly Proceedings	134
New Hampton Institute Program	84	Dean's Conference Proceedings	158
Peterson Dean at Utah	95	Announcement of Awards	ix
H. A. Peterson Receives Award	114	YET Paper Contest	x
Mies Van Der Rohe Honored	114		

ASEE Divisional Publications and Editors xi

Student Subscriptions—As announced in October, with the encouragement and support of the Executive Board and General Council, low-cost student-group subscriptions to the Journal are now available at $1.50 for the nine regular issues, October 1 to June 1 (excluding the *Yearbook*). Letters describing the program have been sent to all deans from Society headquarters, and supplementary invitations to participate have also been issued through the YET organization (Prof. Peter Balise, University of Washington, Seattle, acting informally as coordinator) to the numerous members who had already indicated interest in serving as group sponsors to handle subscription arrangements, distribute Journal copies, and to lead or stimulate student reading-discussions of appropriate articles or Society projects.

To make possible economical administration and to avoid competition with or loss of regular Society membership, the plan has been launched on a group basis for the session, with bulk mailings of Journals (available beginning with October) to sponsors. Second-semester subscriptions as separate units, or other feasible requests for change can be considered, however, as sponsor experience indicates their advantages. Suggestions for improvement are welcomed, and should be sent both to the Secretary and the Editor; subscriptions orders should go directly to the Secretary. (In connection with the program as a means of improving student morale or understanding of teaching problems, and as a way to attract good students into teaching and the Society, the excellent YET Chairman's Message by Harold A. Foecke, page 153, is certainly required reading. From the student point of view, or for discussion, M. Stanley Helm's presentation on "Teaching as an Exciting Career," page 111, is equally appropriate.)

"Recruiting Practices and Procedures"—Separate copies of the Ethics Committee Report, in covers for distribution, are now available from the Secretary at the standard Society price of 25¢ each, with special consideration given to bulk orders for class, placement-office, or industry use. Because other later codes offering considerably less protection for graduates have appeared recently with wide-spread publicity, it seems highly desirable to extend awareness of the Ethics Committee and Society veiws as much as possible. With this in mind, the full report (which had previously been withheld pending possible adoption by other organizations) will appear in the December Journal, possibly as a comparative study.

The JOURNAL OF ENGINEERING EDUCATION, official publication of the American Society for Engineering Education, is published ten times per volume during the academic session (October 1 to June 1, *Yearbook-Directory* issue about February 15) at Urbana, Illinois. Editorial and business offices 114 Civil Engineering Hall, University of Illinois, Urbana (telephone Champaign, Illinois, 76611, ext 3378). Open to selected advertising of service to the Society; advertising rates and mechanical requirements on application.

DO YOU KNOW . . . .

► . . . . That at the June meeting of the General Council only one Section and one Division were not represented? This is a good record, but there is no reason why a perfect representation should not be possible at an Annual Meeting. Surely one interested member of each group was present who would have been willing to represent the Council member! For the meeting in New York on October 26, travel expenses will be paid for members of the General Council (not their representatives) who have a non-industrial affiliation and who cannot have expenses paid from other funds. The meeting follows the joint ECPD–EJC annual meeting.

► . . . . That at its recent meeting ECRC initiated plans for cooperating with the Educational Methods Division to develop a program of research on educational problems in engineering? The Directors of ECRC believed there is a void in the research activities in this area and that the situation should be corrected. Information on what is being done and what should be done is being collected.

► . . . . That a committee of the Educational Methods Division is developing an instrument for evaluating good teaching? Dean R. L. Sweigert of Georgia Tech is chairman. About 1000 copies of the preliminary version will be used this year by ten teachers in various institutions. The form is such that the results can be evaluated on an IBM computer. It is hoped this large-scale trial run will be the last step before publication for general use.

► . . . . That the audit for the year 1956–57 indicates another year of sound financial operation? A favorable balance of about $6,500.00 is indicated. As a result, the Executive Board authorized the transfer of an additional $10,000.00 from unappropriated surplus to the reserve for emergencies. The latter now totals $60,000.00 and is invested in government bonds and savings accounts. The Financial Policy Committee, after having reviewed the pro-forma statement for 1956–57 and the budget for 1957–58 at the Annual Meeting, complimented the officers and the Secretary for the continued improvement in the financial status of the Society. The audit will be published in the February *Yearbook-Directory*, together with the other Society records.

► . . . . That the planning for the "Survey of the Engineering Profession" by the ECPD–EJC Joint Committee is formally under way? The "Bureau of Applied Social Research" of Columbia University has been employed to conduct the study. In its initial report the Bureau divided the problem into four areas—the individual engineer, the engineering profession, the engineer-in-industry, and other possible projects. It is expected the report will be completed in the near future. ASEE's contribution of $1,000.00 to initiate the study was paid last year.

► . . . . That ASEE is participating in the 1958 Nuclear Congress? The meeting will be held in Chicago, Illinois, on March 17–21, and the theme will be "Industrializing the

Atom." The Congress is coordinated by EJC for its member societies, managed this year by the AIChE, and sponsored by the engineering and scientific societies interested in the nuclear field. The Hot Laboratories and Equipment Conference and the National Industrial Conference Board's Atomic Energy in Industry Conference will be a part of the Congress. Also, there again will be an International Atomic Exposition where engineers, scientists, and management men can see and discuss with industrial representatives nuclear processes and materials currently available. The Nuclear Committee is responsible for ASEE's session entitled "Scientist to Executive—Nuclear Training."

► . . . . That the Japanese Society for Engineering Education recently celebrated its fifth anniversary? In establishing JSEE, ASEE was used as the model. The best wishes of ASEE were extended by President W. L. Everitt in a letter to Dr. Kinji Schimizu, President of JSEE. Dr. H. L. Hazen, Chairman of our Committee on Development of Engineering Faculties, was in Japan at the time of the celebration and served as official representative of ASEE.

► . . . . That five universities sponsored two-day area meetings during the month of September to discuss the "Improvement of the Utilization of Engineers"? The special Task Force of the President's Committee on Development of Scientists and Engineers considered this to be the most immediately productive step in getting action on this phase of the Committee's work. Dr. E. A. Walker, President of Penn State, is Chairman of the Task Group, and M. M. Boring, Past President of the Society, is Vice Chairman. Each meeting involves the active participation of local engineering societies. Information regarding the sponsorship of such meetings can be obtained from W. T. Cavanaugh, of EJC's Engineering Manpower Commission.

► . . . . That the Engineering Foundation has withdrawn its financial support to ECPD? The action was based on the established policy of aiding in the initiation of projects and then withdrawing when recognition and worthiness justifies financing on a permanent basis. The EF Board believes the financial positions of the constituent societies now are such that they can adequately support ECPD without restricting its programs. This means that an additional $5,000.00 will be pro-rated to the constituent societies.

► . . . . That EJC is considering sponsorship of a TV program series depicting the engineer and his activities? The individual society whose activity is depicted would receive credit for the program. Final approval of each program would rest with EJC.

► . . . . That the Honors Committee of EJC has been instructed to prepare a set of rules for an EJC award? The award would be made annually at a dinner meeting of EJC.

► . . . . That you should order your copy of ECRC's biennial "Research Review" from Dr. Renato Contini, Secretary of ECRC? The cost is two dollars per copy.

W. Leighton Collins
Secretary

THE REVISED CONSTITUTION

W. LEIGHTON COLLINS

Secretary, ASEE

All of the suggested changes in the Constitution and By-laws were approved by letter ballot in the spring and by action of the Society at the Annual Meeting. All of the proposals, you will recall, were incorporated in the Constitution and By-laws printed in the April, 1957, issue of the JOURNAL, The major change, as it immediately reflects on individual members, is the method of electing officers.

The President, Treasurer, and four Vice Presidents are now to be elected by letter ballot of the entire membership. At the beginning of the academic year each individual member is furnished a form on which he can submit names of persons to be considered by the Nominating Committee. (You already have received such a notice and it had to be returned to the Secretary's office by September 25.) The Nominating Committee consists of the elected members of the General Council serving the second of their two-year terms, and the three immediate past presidents.

The Secretary's office tabulates the suggestions received and sends a copy to each member of the Nominating Committee. At the fall meeting of the General Council (October 26, this year) the Nominating Committee meets and selects candidates whose names are then announced to the entire membership. There follows an opportunity to nominate by petition, and in February or March a ballot is provided each individual member. Thus, as of April 1, the new officers will know of their election; they can attend the spring meeting of the Executive Board, and they can have committees named by the time of the Annual Meeting in June.

Another change to note is that there are two more vice presidents than in the past. This will make possible a closer coordination of activities and an establishement of workable areas of responsibility.

The election of honorary members is also reduced to a more convenient system. Did you know only two have been elected and that A. A. Potter is the only living honorary member? It is desirable that serious consideration be given to this selection, and that you inform the Chairman of the Honorary Membership Committee, W. T. Alexander of Northeastern University, of your recommendations. Two honorary members can be elected each year.

Most of the other constitutional changes can be classed as minor, but they are significant in that they reflect much grass-roots thinking. It is believed that the Society's structure has been modernized to conform with present practices of professional organizations, particularly insofar as speeding of processes and actions is concerned. Classes of members have been redefined, the functions of the Executive Board clarified, the position of Editor of the JOURNAL OF ENGINEERING EDUCATION provided for, and the amendment of by-laws is simplified. For the details regarding all the changes, refer to the April JOURNAL, p. 703; you will better know your Society and its functioning if you carefully read those ten pages.

RESEARCH AND ENGINEERING EDUCATION

ERIC A. WALKER

President, The Pennsylvania State University
University Park, Pennsylvania

An address before a joint dinner meeting of The Engineering College Administrative Council and The Engineering College Research Council, Cornell University, June 18, 1957.

About the middle of last year, the number of people employed in the production of goods dropped behind the number of people employed for all other purposes for the first time in America—or in any other country, for that matter. In commenting editorially on this fact, the *New York Times* stated that "History sometimes happens quietly, without parades, without decisions and debates, even without any body knowing at any determining instant that the change has come about. The clock may strike so softly that we do not hear it."

Perhaps in this case the change wasn't recorded by the striking of a clock at all. Perhaps instead of listening for the clock to strike, we should have paid more attention to the crack of a jet fighter as it crashed through the sound barrier. The speed with which man can conquer distance is perhaps as good an indicator of what is happening as any other.

Speed As A Criterion

From the beginning of recorded history to the cracking of the "oats barrier" with the invention of the "Iron Horse" in 1830—that is, for more than 30 centuries—man could travel no faster than the speed of a horse. Progress chugged along until, in 1907, the Wright brothers exhibited an airplane that could fly 500 miles at an average speed of 50 miles an hour.

By the end of World War II, we had upped this to about 470 miles an hour. That is, it took us almost a century to achieve speeds 13 times as great as those possible with a 35-mile-and-hour one-horsepower horse. But then we really went to work on the problem. Not long ago, a speed of over 2000 miles an hour was recorded for a piloted aircraft—three times the speed of sound, 40 times greater than the speed achieved by the Wright brothers just 50 years ago, and 60 times greater than the speed of the winners of the Kentucky Derby.

The popular name for the movement that has made possible changes of this sort is "automation." Only two things about automation, however, are new: (1) the word "automation" and (2) the accelerated pace with which the principles and techniques of automation are being used in modern-day technology. Quite simply, automation consists of applying energy to automatic processes for doing the things and producing the machines that people want.

Today automation is a dynamic force in almost every phase of our lives. The movement is significant not simply to our technical community but to the whole of our social and

economic life. The effects are felt at every level of our society and have actually changed the structure of it.

Whole new industries have grown up about it in the last few years. It has led to new professions and to new techniques and skills in older ones. It has a tremendous effect on our economic structure and has invaded our cultural activities. It has changed our pattern of living and perhaps even our pattern of thinking. Certainly it has been a powerful force in the shift, since 1900, from a basically rural society to a basically urban one in the United States.

Background for Recommendations

But where is all this taking us? Let's look briefly at some of the aspects of our economy. The production of steel is often considered one of the best indices of our performance because of the wide use of steel in our industrial world. At the turn of the century, our steel production was just over 10 million tons a year. In 1956, it was almost 115 million tons.

The *New York Times* business index, based on an arbitrary norm of 100, has shown an almost linear increase from a starting value of 80 in 1935 to a value of a little more than 210 at the end of 1956. Wages show the same trend: the median yearly income for all wage earners was $956 in 1939; in 1954, it was $3174. According to a recent article in *U. S. News and World Report*, the average pay for electricians in 1940 was $2141 a year; today it is $6788. Salaries for steel workers have risen from $1624 a year in 1940 to $5433 today. The average factory worker received $1310 in 1940; last year his salary was $4286.

Not all this increase, of course, accrued to the wage earner, since inflation and higher taxes took some of it. But not all of it. In 1940, the average manufacturing worker had a take-home pay of $24.95 a week; in 1950, after adjustment for the rise in living costs, the worker had a purchasing power—in terms of 1940 dollars—of $38.19, a gain of 53 per cent.

A more scientific index is the gross national product, the dollar value of all goods and services produced in the country throughout the year. In 1940, the gross national product was about 180 billion dollars. In 1954, it reached a peak of 365 billion dollars, and Burns, the economic advisor for the Administration, predicted a GNP of $440 billion by 1960. The GNP actually reached $427 billion in the first quarter of 1957, and government economists now believe it will reach $500 billion by 1960. Other predictions are much higher.

In yet another index, the man-hours per unit of output dropped from 1.0 in 1910 to 0.4 in 1955. This means we have increased our productivity six per cent per year, which could be translated either into more products or into fewer hours of work for the same product. This figure agrees closely with the annual increase shown by the *New York Times* business index. Therefore, it looks as though we can safely expect to go on doubling our productivity or the things we have in each 15-year interval—*if* we can continue to supply our industrial machine with the things it needs for its expansion.

What are these things? Certainly they include materials, energy, and

people. Let's look briefly at the situation with each of them.

Materials

Despite what seems to be the popular opinion, America does not have an inexhaustible supply of raw materials: coal, iron, tin, zirconium, and so forth. In addition, as our technology becomes more sophisticated, we need more sophisticated materials—materials with a higher melting point, materials with a higher yield strength, materials that are resistant to corrosion, etc. We get these materials essentially from one of two sources: some of them are milled from ores stored in the earth, while others are made from plants we grow.

Those that are stored in the earth are, in general, much like capital assets—they can be used only once. The ones we use today cannot be used by our children or our grandchildren. We can see this easily with fuels such as coal and oil: we can burn them only once. But it also is largely true of many of the primary metals. In fact, our supply of tin is becoming so scarce that it has been seriously suggested that in the future we may have to mine the city dumps, not simply to reclaim the tin lining but also the steel out of which the can is largely made.

The materials problem isn't as dark as it might look at first glance, however. Recent developments have proved to us that we can use the metals that we have more efficiently than we have been using them and that we can use materials derived from agricultural products.

We now know we can improve on the inefficient "cook-book" methods we have used in the past to get the materials we need. Until quite recently, our lack of fundamental information about the materials we used caused us to have to design for something we call a "factor of safety." Actually, it should be called a "factor of ignorance." Because of this factor of ignorance, we realize only about 10 per cent of the full potential of our materials.

We can no longer afford the inefficiency of a 90-per cent factor of safety, and we face technological stagnation if we do not find ways of reducing it. However, the fact that we are not now realizing the full potential of our materials is, in itself, encouraging: because of this fact, we know the problem admits of solution by human resources.

Further, we are now turning more and more to materials manufactured from the things we grow. We now use casein from milk, the oils from cotton seed, and the flour from soy beans to manufacture plastics and other materials that often surpass the metals they replace in mechanical, electrical, and structural properties. As our ignorance is eroded, we will begin to design materials for the temperatures and stresses needed to realize better machines. We must do this soon, but we know it can be done.

Energy

Until recently, we were pretty much stuck with the same sources of energy used by those who pioneered the industrial revolution. In effect, we were —and still are, for all practical purposes—working on our past savings by using the energy stored by nature in the fossil fuels. We have been using up this supply at a fearful rate and face the prospect of total exhaustion within a relatively short time.

The discovery of atomic fission and fusion, however, has completely changed the picture of the available supply of energy.

The potential power residing in uranium, for example, is staggering. One pound of fissionable fuel contains about 10 million kilowatt-hours of energy, the equivalent of over 2½ million pounds of coal.

We still don't know how to extract energy by atomic fission efficiently. We don't know yet how to extract the power residing in atomic fusion at all. Yet we know that energies much more powerful than the nuclear fires of hydrogen bombs would be released if the nuclear "glue" of atomic hearts could be weakened, and studies are already being made to discover the nature of the forces that keep the atomic core from flying apart in spite of tightly packed positive charges.

Nor do we know yet how large a supply of atomic fuel we have. For one thing, we haven't yet catalogued all our supply of uranium. For another, we don't yet have a complete list of the materials that can serve as atomic fuel. If, as many experts think, thermonuclear power can be created from lithium and deuterium, our energy problems seem to be solved for nearly all times. The reserves of lithium in the earth's crust and of deuterium in the ocean's water are practically inexhaustible.

We are making significant progress, too, in our efforts to harness the energy dumped each day on the earth by the sun. Although it is true that we use the sun's energy to grow plants for food, building materials, and fuel, nature's methods are inefficient; we realize only about one per cent of the solar energy required to grow our most efficient crop—a field of sugar cane. The sun's energy is too important to waste in this way; in areas of plentiful sunshine, more energy is received on the rooftop of the ordinary house than is carried into the house through electrical wires.

Today several methods of collecting and converting solar energy are being studied. The most promising of these seems to be the solar battery, which converts energy from the sun directly into electricity through photoelectricity. A battery of this sort recently developed by the Bell Telephone Laboratories generates enough current to keep a common storage battery used in telephone operations fully charged.

People

We can, it is clear, solve our problems with materials and energy. Manpower, however, is quite a different thing. Changes as fundamental as those that are now taking place in our society cannot help but cause shifts in our manpower needs, and the shifts themselves can tell us something about the changes that are taking place and give us some hints of what we must do about them.

Between 1940 and 1950, the total labor force in America increased by about 35 per cent; during the same period, the number of farmers decreased by around 27 per cent, but the number of research workers increased by almost 100 per cent and the number of engineers by about 200 per cent. Between 1947 and 1955, output in the electrical manufacturing industry increased by 87 per cent, but the number of production workers increased by only 14 per cent.

In contrast, the number of non-production employees, which includes

the engineers and scientists, increased by 40 per cent. In 1900, about 200 factory workers were employed by industry for each engineer; today, the average is about 50 to 1, and some industries find it necessary to employ one engineer for each ten factory workers.

The significance of figures such as these is perfectly clear, I think. We are becoming increasingly dependent upon highly trained professional manpower for the health of our economy, for our continued technological and scientific advance, and for the maintenance of our ability to protect our way of life.

Effects of Automation

This shift was inevitable in automation. By definition, automation replaces unskilled labor with machines that do the work faster, more accurately, and less expensively. But it requires a high level both of intelligence and training to design the machines and keep them running, to prepare the information for them and to interpret the results they produce.

In a sense, we replace large numbers of our least talented, least expensive labor with smaller numbers of our most talented, most expensive labor. This fact, combined with our continued expansion, has created a shortage of professional workers that threatens our entire economy.

The fact of this shortage has been dramatized by the desperate search for talent being carried out by industrial organizations. In 1954, 40,000 engineers were needed; our colleges and universities provided only 22,000. The shortage, of course, is accumulative; in 1956, more than 80,000 were needed, and we graduated fewer than 29,000.

This shortage of engineers and scientists is felt throughout our social structure and not just in the industrial world. Undoubtedly, it accounts in part for our severe shortage of teachers; some experts estimate that our supply of teachers is dropping behind demand at the fearful rate of 60,000 a year, and that the deficit may reach 500,000 by 1966.

By outbidding our schools for the best talent, industry is draining off a large percentage of our superior teachers and, by doing so, may be guaranteeing that the shortage will last for many years to come. The number of teachers qualified to teach physics, for instance, has decreased by almost 75 per cent in the last several years, and the well-qualified high-school science teacher has all but disappeared.

Some find encouragement in the population statistics. They point out that probably twice as many prospective students will seek admission to our colleges and universities in 1970 as did in 1954. To wait for the college-age population to catch up with demand, however, would be to invite disaster.

By this slow process, we could not graduate enough engineers to supply the annual demand until 1970, if the demand did not increase from the present figure. By that time, the backlog of needed scientists and engineers would number perhaps half a million, and our economy would probably be permanently impaired.

Will Enrollments Help?

Actually, we cannot solve this shortage simply by increasing the number of freshmen we enroll in our colleges of engineering. There just aren't enough young men available with the proper intellectual potential.

Let's look at a few figures. The President's Committee on Education Beyond the High School estimates that 1½ million students will graduate from high school in 1960. About half, or 750,000, of these will be boys. Only about 10 per cent of these, or 75,000, will have the intellectual capacity to profit from a rigorous professional education. And experience shows us that about one-fourth of these will have no desire to continue their education beyond high school.

The potential reservoir of raw material from which we must supply the annnual demand in our top professional fields is thus reduced to about 56,250. Since the shortages in the other top professional fields—the doctors, the lawyers, the scientists, and the others—must also be supplied from this reservoir, it is obvious that we will not be able to get all the people we need. The rise in student-age population, as striking as it is, just cannot keep pace with our needs.

There is an even more fundamental reason why we shall not be able to do so. By its very nature, activity in engineering and science generates more activity in engineering and science. It's like Cracker-Jax; the more engineers we put to work, the more we will need. Only a mere handful of hardy visionaries were required to make the break-through in atomic energy, but they created a field of inquiry in which 134,000 people were at work by 1955.

Nine Recommendations

What can we do about this dilemma? I suggest a nine-point program.

(1) *Our first task is to identify our potential material.* Surveys show us that about half of those qualified to profit from professional training fail to continue their education beyond high school. To salvage any of these, we must know who they are.

In addition, it now looks very much as though the colleges and universities of the United States are going to have to limit their enrollments even more severely in the future than they have in the past. If we must do so, we should make every effort to enroll those who can profit most from our curricula.

To this end, I propose that we establish a nation-wide system of qualifying examinations for testing all students twice during their pre-college training—once at the ninth grade and again at the twelfth grade. Such a system would provide an orderly and productive method of discovering potential talent to replace our present haphazard, unsystematic ones.

(2) *We must be certain to instill in our superior students the desire to go to college.* About half of those who do not continue their education beyond high school fail to do so because they lack motivation. I strongly suggest that parents must do a better job in this area than they have done in the past; we cannot leave the whole problem to the high school teachers and counselors. In my experience, the ages between nine and twelve are best for this sort of motivation. At these ages, the influence of the parents is particularly strong.

(3) *We must make it financially possible for each gifted boy and girl*

to attend college. The other half of those who fail to go on to college do so because they do not have enough money. I don't suggest that this aid be provided in the form of Federal grants that do not have to be paid back. Such a program would, it seems to me, almost surely be misused.

Rather, I suggest a system of Federal scholarship grants that would have to be repaid as a surcharge on the recipient's income tax beginning five years after graduation. Repayment of these scholarships, which should be awarded on the dual basis of need and of capacity to profit from a professional education, would be spread over a ten-year period.

(4) *We must educate all students to the highest levels at which they are capable of profiting:* the artisans at one level, the engineering and scientific aides at another, the ordinary engineers and scientists at still another, and the most creative ones at the highest of all, the doctoral level.

Actually, the traditional one-tier educational program offered by colleges and universities is extremely wasteful of brainpower. Not all young men and women have the same capacity for education, just as not all people have the same capacity for playing the piano. By forcing all those who come to our schools into one educational mold, we fail to provide the most gifted ones with challenges sufficiently vigorous to develop their full potential.

In fact, we are more apt to implant habits of mental laziness by offering such students courses in which they can get good grades and perhaps even win honors without "cracking a book." Further, we lose the less gifted ones altogether by forcing them into courses beyond their mental capacities.

Our colleges and universities must recognize this truth and devise graduated educational programs that will make it possible for each student to work at his proper level—the highest level attainable by the student.

(5) *We must learn to use our engineers efficiently.* Few people, I expect, can actually say whether or not we are using our professional manpower at its highest level; in fact, I expect few people could measure this sort of efficiency at all. But if, as engineers and scientists, we are really interested in research, wouldn't this be an extremely interesting and profitable area for investigation?

If we could devise means of saving 10 per cent of the average engineer's time in a week, we could, in effect, increase our engineering force by 50,000 men. Shouldn't someone, some company, some government agency, some engineering experiment station, start to make some fundamental studies in this area so that measures of engineering efficiency could be established and companies could quit stockpiling manpower?

(6) *We must,* I think, *bring our Selective Service System up to date.* The purpose of this system is "the maintenance of the national health, safety, or interest." To provide for this, we either draft a young man into one of the military services or we defer him. Those drafted serve at the lowest military level, despite whatever potential specialized talents they might have.

This year the number of young men drafted for military service has ranged from 17,000 in January to 13,000 in May. Yet about 40,000 boys are be-

coming eligible for the draft each month. Some of these, of course, are unfit for military service, but many are evidently being deferred almost permanently just by chance.

How many of those being drafted are good engineering and scientific material? How many of those being deferred have any real reason for deferment? I don't know. According to an article in a recent issue of *Reader's Digest,* the Army alone has 5,000 engineers and scientists serving as Privates and Corporals in duties that have little to do with their specialized training and talents.

Every potential scientist and engineer drafted for general military service represents a significant disservice to the national interest. Further, every deferment might easily represent a lost opportunity to train a boy for national service at his highest potential. The one does harm; the other fails to do good.

I suggest, therefore, that we change our concept from "military" service to "national" service. We can then work out a system in which we can put those who ought to go into military training into that branch and those who ought to go into our national laboratories in time of national emergency into training for such service.

I understand there are about 43,000 classified engineers working for the Federal government. In an emergency, the number needed will increase tremendously. Let us, then, train our potential engineers to step immediately into these military laboratories in an emergency.

We could pay all alike—the military trainees and the engineering trainees —we could give them all the same basic training in the type of discipline necessary to meet a national emergency—we could house all alike in barracks. But we could prepare the potential engineers and scientists for service in the *national laboratories* rather than in the front lines—to *develop* weapons and tactics rather than to *use* them.

(7) *We must do everything we can to bring about the elimination of the costly and wasteful cost-plus-fixed-fee type of government contracts.* Such contracts, by encouraging expensive recruiting drives, wide-spread pirating of personnel, the stockpiling of engineers and scientists, and exorbitant short-term salaries, are costing the taxpayers millions of dollars a year from which they get nothing in return. Perhaps more serious, this practice is reducing the effectiveness of our engineering force through program interruptions and personnel dislocations in all areas.

A study by a Civil Service Commission on the West Coast showed that 134 of the 194 scientists and engineers who left the laboratories served by the Commission during the period of the study did so for higher salaries. Of these, 83 per cent went to work for defense contractors, but only 46 per cent were utilized at higher levels of responsibility than had been the case in their old jobs! They were being paid more money—derived from Federal funds—for doing the same or comparable work.

A recent Navy survey showed that 37 Navy contractors spent an average of $808 to recruit each scientist and engineer, while 17 concerns not holding government contracts spent only $502 to recruit each technical employee. Since almost 8000 employees were involved, the cost to the govern-

ment from cost-plus contracts was almost $2½ million.

Even more serious and costly, however, is the stockpiling of engineers, the program interruptions, and the wasteful use of technical manpower that the practice encourages. We can no longer afford such extravagant practices.

(8) *We must find some means of financing basic research in engineering,* much as the agricultural interests have had for years through the Federal and state-supported experiment stations. Last year Penn State received nine times as much for noncontractual research in agriculture as it did for nonsponsored research in engineering subjects.

There is no doubt but that the money spent for agricultural research was well spent. Despite decreases in both acreage under cultivation and number of people engaged in farming, between 1930 and 1955 farm production increased at the very substantial rate of two per cent a year and output per manhour almost doubled.

This expenditure amounts to a national research subsidy—a type of subsidy that is given to no other segment of our society. Research in the physical sciences, in engineering, in the social sciences, business, and the humanities must be purchased by the individual or group desiring the information, or funds must be provided from state sources. The farmer has come to expect this sort of help, but almost no one in industry or labor does, quite simply because it has never been offered.

Several bills have been introduced into the Congress of the United States in the past to correct this inequity. Chief among these was one to grant Federal funds for establishing engineering experiment stations similar to those established for agriculture by the Hatch Act. Though introduced for several sessions in the early 1940's, the proposal was defeated on each occasion by disputes over where the stations were to be located.

No one can oppose the basic need for such legislation. Today's economy rests in every area basically on research. But research is expensive—too expensive for the small enterprise operating independently. Unless such smaller enterprises, the independents, get help, they are likely to be squeezed out of existence as business multiplies, merges, and diversifies and as decentralization moves giants into every corner of American enterprise.

The time has come, then, for us to lay aside our petty rivalries so that we can give concerted support to increased aid for noncontractual, nonprogrammatic basic research in engineering fields.

(9) *Finally, the time has come,* it seems to me, *when we must look at the curricula we offer and the methods we use to teach them.* Are our courses the best we can devise to prepare a young man for professional work in today's complex technological society?

Can we meet the instructional loads required of us with the faculty we shall be able to get in the next few years using traditional methods of teaching? In fact, are the traditional teaching methods the best methods? Are we making the best possible use of new techniques and equipment we ourselves have devised for others?

One of the chief complaints made by those who hire our product is that we fail to teach the fundamentals.

They say *they* can teach the techniques, the special skills and applications, but that it is up to *us* to lay the foundations upon which these specialties can be based. They want us, they say, to produce *engineers* first, and mechanical engineers, electrical engineers, or what have you, only as a secondary concern.

Along with these demands, we face continuing pressure from non-engineers to increase the amount of humanities we offer—courses not designed to increase the engineer's proficiency as an engineer but as a citizen, a man, and a manager. If the engineers are going to run the world, they must have other tools than their slide rules and handbooks.

What is the answer to these conflicting trends and demands? Could it be that we should revise our course structure to offer a common curriculum to all engineering students during the first two years? Isn't it possible that the similarities during this period are more significant than the differences?

And isn't it possible that, after the first two years, we should divide our curricula not along traditional subject-matter lines that often have little meaning today in actual engineering practice but along functional lines? Instead of training electrical engineers, mechanical engineers, and so forth, perhaps we should train research engineers, development engineers, production engineers.

That is, perhaps we should revise our curricula to agree more closely with the divisions made by the organizations who use our product. Such a revision might emphasize the basic knowledge needed by our students and de-emphasize the trend toward fragmentation that is making the term "engineer" meaningless without a qualifying term.

And how about teaching methods? Isn't it possible that we should do some research to improve our traditional methods? How about the possibility of putting closed-circuit television in dormitory rooms? Experiments carried out on a limited scale show that certain kinds of courses can be taught by television as well as, if not better than, by older direct-contact methods.

And shouldn't we consider putting our brighter students more on their own—giving them more responsibility for their own education? One of the criticisms of American higher education is that we spoon-feed far too much. How about the possibility of using teaching aides to help our better teachers to teach more students effectively? The method has worked in industry.

Research on Teaching

These are not proposals; they're not even suggestions. I use them simply to illustrate the need for research into what we teach and how we teach it.

You will observe that all these suggestions involve a new type of research for our engineering schools. We have made brilliant records in research with *things*—materials, processes, methods, and the like. Now we face a crisis in which we need to apply our talents for research in yet another direction. We need research involving the *shortage* of *professional skills* and *knowledge* and methods by which that shortage can be ended.

Next, we need research involving teaching methods and evaluation or selection of the subject-matter for the courses we offer. We need research

involving engineers—their training, their conservation, the conditions under which they work, the types of organization within which they should work best.

Notice, however, that I say we need *research* in these areas. I do not wish us to be so panicked by the problems facing us that we find ourselves in the position of the hero of a story I heard the other day. It seems that he survived a major hydrogen explosion only to find that, insofar as he could determine, he was the last person left alive on the face of the earth. He reasoned that it was pointless to prolong a life of solitary splendor that could lead to nothing. Consequently, he climbed to the top of the Empire State building, which had been left standing, and jumped off. As he passed the 44th floor, he heard the telephone ring.

In the next fifteen years, engineering education in the United States is going to be revolutionized. We must remember that revolutions often destroy without producing anything to fill the void. If the sweeping changes that are going to take place in the next few years are to produce a sounder, better system of engineering education, we must frankly recognize the problems that we are going to face, work out sane, logical solutions to them, and then proceed systematically and courageously to carry them out as well as we can.

HARRY STANLEY ROGERS

Dr. Harry S. Rogers, distinguished President of the Polytechnic Institute of Brooklyn, died suddenly June 6, 1957, at 66 years of age. After graduating from the University of Wyoming in 1914, he became an Instructor in civil engineering at the Universities of Iowa, Wyoming, and Washington, Assistant Professor of civil engineering at Lafayette College, Pennsylvania, and in 1920 Professor of hydraulics and irrigation engineering at Oregon State College. There in 1927 he was appointed Dean of Engineering and in 1928 the first Director of the Engineering Experiment Station. He served in these positions until 1933, when he was named President of Polytechnic.

Throughout his career, Dr. Rogers was active in ASEE, serving as President from 1944 to 1946; Vice President, 1932–33; and as a member of the General Council, 1928 to 1931 and 1944 to 1949. As President of the Society in 1945, he was chairman of the committee to write the new constitution under which the Society for the Promotion of Engineering Education and the Engineering Research Association were united into the ASEE. In 1953 Dr. Rogers was awarded the Lamme Award.

BASIC CONSIDERATIONS IN SALARY ADMINISTRATION

For Engineering Faculties

M. R. LOHMANN

Dean, College of Engineering
Oklahoma State University, Stillwater

Presented at a conference of the ECRC, 65th Annual Meeting of ASEE, June 18, 1957.

It is probably unnecessary to state that a salary is seldom the primary incentive for teachers or for professional men generally. Many studies of various groups of industrial employees indicate that the wages and salaries are not among the top motivations. C. H. Lender ("Obligations of Engineering Management in a Large Decentralized Company," *Electrical Engineering*, December, 1955) lists three motivating factors in the following order:

1. An opportunity to do good work.
2. Good facilities.
3. An appropriate reward for good performance in the form of compensation, recognition, and work security.

The Final Report of the Committee on Recognition and Incentives for Good Teaching of the American Society for Engineering Education similarly lists the opportunities sought by a teacher as:

1. Opportunity to work toward known educational objectives. These must be declared by his college in sufficient detail to permit the teacher to plan and evaluate effectively.
2. Opportunity to work with competent students whose objectives are sincerely in accord with those of the college.
3. Opportunity to work with adequate classroom, laboratory, and library facilities in suitable surroundings.
4. Opportunity to improve teaching conditions encountered in his work by direct experiment or by recommending related investigation and action.
5. Opportunity to belong, and to share in planning the program with confidence that his contribution is valued.
6. Opportunity to contribute to his profession in education, science, engineering, or the humanities with confidence that the college applauds his activity.
7. Opportunity to work with congenial and respected colleagues.
8. Opportunity for the self-development particularly valued by young men.
9. Opportunity for the teacher and his family to live a full and enjoyable life.

It is interesting to note that in both reports, compensation is the *last* item listed. However, all administrators recognize that if salary administration is inadequate, salaries can be the major cause of dissatisfaction and poor morale.

Objective

A salary administration program must have an objective, one which is known and clearly understood by administrators at least.

The objective of any salary administration program is to determine and pay salaries in a manner most satisfactory to faculty so that greater future productivity will result. As cited in

the introduction, salaries are a part of the system of incentives that influence men to cooperate. Men are rewarded generally on the basis of the work performed or service rendered in the present to provide an incentive for the maintenance of or increased productivity in the future. The problem of salary administration is to so determine and divide the available funds for salaries among the faculty so that the faculty as a whole will maintain or increase their productivity.

Productivity in the educational system is primarily some combination of quantity and quality of student credit hours as defined by the college administration or the faculty. The opportunity to work toward known educational objectives is listed first by teachers. Thus, the first basic consideration of salary administration is the definition and promulgation of the educational objectives. Salaries are a means to stimulate the faculty to attain these objectives.

Teachers are the Judges

Although the amount of the salary may be determined by others, the determination of whether a particular salary is fair and equitable and thus satisfactory is always made by the teacher. The salary is intended to favorably influence the teacher, not the administrator who may determine it. If the teacher believes that his salary is not fair and equitable, the value of the salary as an incentive is decreased and he withholds his cooperation in whole or in part.

It is recognized, of course, that it is impossible to devise a system of salaries that will be entirely satisfactory to all teachers. For example, an increase in salary for one teacher in a department may stimulate him, but may also discourage others. The objective of the salary administration program is to satisfy and motivate as highly as possible the whole faculty. The final objective desired is always greater productivity, and the means of attaining this goal are capable teachers willing to work and to cooperate.

Systematic for Consistency

Whether salaries are determined by administrators or faculty committees is probably less important than the method employed in the determination. To teachers the most satisfactory manner of determining compensation is by the employment of a *systematic technique to achieve consistent results.*

Consistency is the key to a successful salary administration program. All teachers must be compared to the same standards of effectiveness in reaching the pre-determined educational objectives.

The public school teachers have tended to prefer the consideration of seniority and degrees in determining salary increases because this consideration is systematic and achieves consistent results.

Unless college administrators use some systematic procedure in measuring faculty progress in reaching educational objectives, college faculty will demand that they be measured by a means that achieves more consistent results.

A salary is more or less satisfactory in terms primarily of two factors. The first is *internal consistency*—acceptable relationships of salaries paid teachers within a university. The second is *external consistency*—acceptable relationships of salaries between faculties in a university and men per-

forming similar functions in other organizations.

Internal Consistency

Administrators of salaries should give consideration to two aspects of a salary—the absolute amount and the relationship of it to other salaries. The absolute amount of all salaries is the total payroll—and is of more concern to administrators than teachers. The relationship of the salary to other salaries is considered fair by the teacher if it reflects his estimation of differences in either or both job difficulty and teacher performance.

It has been conclusively demonstrated that, to the teacher, an equitable relationship is more important to his satisfaction and morale than the absolute amount of the wage. This fact is often obscured by the publicity given demands for higher salaries. It has been stated that the absolute amount of the salary may be a cause for a teacher's "unsatisfaction" and the lack of equity of the relationship a cause of "dissatisfaction." The "unsatisfied" teacher may be cooperative and productive; the "dissatisfied" teacher seldom is.

A salary is neither high nor low until it is compared to other salaries on the basis of some factors or qualities. A salary is "out-of-line" only when compared to salaries that are "in-line." If a company of soldiers were marching down the street and one had started with his right foot instead of his left, that soldier's mother standing at the curb might say, "Look, everyone is out of step but my Johnny." But the company of soldiers would say, "Johnny is out of step." In very much the same way, there is a relationship between job difficulty and teacher performance and salaries that is considered by teachers to be "in-step" and equitable. Salaries considered by them to be inconsistent or "out-of-step" are those that do not conform to this relationship.

It is the function of administrators to discover the factors and their individual importance of this generally agreeable system of relationships between teachers and salaries. It is also the function of administrators to establish a consistent procedure for considering these factors and their importance for teachers.

It is less important for administrators to invent or create new criteria for measuring teachers than to discover the criteria now employed by teachers for measuring themselves. One must always remember that in the final analysis, the teacher decides whether the salary will incite him to achieve the educational goals desired.

External Consistency

While the comparison teachers make of salaries within the university is still most important, the comparison a teacher makes between his salary and rates paid by other universities and by industry is steadily becoming more important.

The need today for external consistency has been forcefully stated by the ASEE Committee as follows:

> Education in America has traditionally been subsidized in part by withholding remuneration which the teacher has rightfully earned. The public has been conscious that teachers' salaries have not constituted a fair and just compensation for services rendered. With the exception of a few periods such as the present, there have been enough scholars to staff our schools who had private resources or who were sufficiently dedicated to ignore poverty. It is truly amazing that under

the existing degree of this handicap education in America has attained such a high level. Nevertheless, its possible accomplishment has most certainly been curtailed by this attitude toward restricting motivation for good teaching. That much of the public resignation toward inadequate teachers' salaries was not generated by the colleges is difficult to prove. Ambition to explore additional areas of educational service and to become big in student enrollment has led colleges to stretch their finances and perpetrate the tradition of the threadbare scholar. While the standard of living was rising about him, profoundly aided by his contribution, the college teacher witnessed his relative financial status deteriorate and the total college budget grow with tremendous momentum. Incentive to devote a life to teaching has withered at the very time when critical need for teachers has developed. At no level is this more evident than at that of the part-time graduate teaching assistant who has traditionally been financially starved while the college was preparing him for teaching. This prospective teacher is now witness to a contradiction wherein the new graduate receives a salary in industry which is greater than that of many college teachers.

The Right of Appeal

Equally important with internal consistency and external consistency to teacher morale is the right of appeal. The right of appeal assumes that faculty members have the right to information on the salaries paid others of the same rank.

Most colleges and universities conduct their salary administration program in a manner that allows faculty members to learn the salaries of colleagues. With this knowledge, a teacher can make a comparison of his salary with those of others to determine "internal consistency." If his comparison causes him to feel that his salary is "out-of-line," he should have the right to request clarification.

The right of appeal includes a review and reappraisal by the administrator of the teacher's progress in reaching the educational objectives and the right of the teacher to discuss his salary problem not only with his immediate superior but with his superior's superior. The right of appeal does not necessarily presume a review by a faculty committee, although that may be included.

Conclusions

The basic considerations of salary administration for faculty are:

1. The objective of such policies is to stimulate faculty in attaining educational objectives.
2. These objectives must be defined and made known to the faculty.
3. A teacher decides whether a salary motivates him on the basis of (a) internal consistency and (b) external consistency.
4. Although seldom used, the right of appeal without prejudice must be available.

NEW HAMPTON INSTITUTE PROGRAM

Hampton Institute, Hampton, Virginia, is instituting a new degree-granting program in engineering. Mr. V. M. Smith of the General Electric Company has been appointed Director of the Division of Technology to plan and place in effect an accredited program.

UPRIGHT STUDENTS– UPRIGHT ENGINEERS

PAUL H. ROBBINS, P.E.

Executive Director, National Society of Professional Engineers
2029 K Street, N.W., Washington 6, D. C.

ASEE Conference on Ethics, Cornell University, June 20, 1957.
Recommended by the Ethics Committee.

Whether it is a sign of age, or whether it is a common problem in the profession, a frequent point of discussion among senior engineers poses the question, "How can we instill professional concepts in the young engineers of today?" This is an age-old query, and I imagine the senior engineers for the past fifty years have been decrying the fact that the modern generation does not have a sufficiently sound grounding in professionalism to carry the torch the older engineers feel will assure the status of engineering to which we all aspire.

Is the problem then any more serious today than it has been over the years? Is it a problem which justifies attention by educators? If activity in professional societies is any criterion of the degree to which professional concepts have been instilled in our engineers, then a recent study by the Professional Engineers Conference Board for Industry in cooperation with the National Society of Professional Engineers would present some sobering statistics.

In this study of engineers having less than fifteen years' experience, only one out of two indicated they even belonged to a professional society, and of those who belonged less than 10 per cent indicated that they were very active. This same study indicates that while engineers aspire to professional status they are doing little about it.

The report has this to say: "From their comments it is questionable whether many engineers are convinced that they are professionals. Often their comments reflect the belief that they are just employees, and as such to aspire to professionalism is unrealistic. The engineers confess that their own group lacks professional spirit and lacks emphasis on professionalism."

While the profession has noted with some gratification the recent election at the Minneapolis-Honeywell Plant in Minneapolis with respect to the desires of the professional employees for union representation, the fact that one out of three of those professional employees voting felt that a labor union was the organization in which they wished to place the future of their careers cannot be ignored. These then are sobering studies and would support the wisdom of our giving serious consideration to this age-old question of instilling professional concepts in the engineers of tomorrow.

It is undoubtedly appropriate that we should include such considerations in a discussion of ethics. Too often in such discussions, we tend to associate our ethics with canons or creeds. Webster's dictionary gives the following definition of ethics: "The science

of moral duty; more broadly the science of the ideal human character and the ideal ends of human action. The chief problems with which ethics deals concern the nature of the highest good, the origin and the validity of the sense of duty, and the character and authority of moral obligation." Interpreting this definition in terms of professional behavior, we must recognize standards higher than those expected in normal human behavior, for members of a profession are traditionally considered leaders, and because of their additional training are expected to act as models toward which others may aspire.

Meaning of Ethics

What then do we mean by ethics? Is it a canon stipulating a set of behavior criteria? Is it a creed to which we pledge allegiance? Is it a statement of behavior by which we are judged? It is undoubtedly all of these things, but these are outward evidences of a much more fundamental concept, namely: the basic attitude with which we approach our daily tasks. This then becomes a personal matter.

While we speak of ethics of a profession, or professional concepts, we infer by these terms a collective reaction to the basic individual attitudes of the practitioners of that profession. Thus, we come to the basic question with which we are concerned: how can we instill in the engineers of the future an attitude toward their profession and their assignments which will be, as Francis Bacon said many years ago, "an ornament thereunto"?

Because these concepts are primarily individual, we ofttimes think of ethics in terms of the relationship between the individual and a client. This is the most common conception of the professional relationship. Too often in discussing ethics with students, and even within the profession, however, we tend to write and think and establish rules in terms of their application solely or mainly of the practice of consulting engineers.

As teachers of engineers, we must revise this concept to realize that at best only one out of ten of our students will experience or follow this consulting relationship. Thus, the instilling of professional concepts should be oriented primarily to the ethics involved for the *employed* engineer.

There are perhaps three general areas of attitude on which more emphasis needs to be given in our collegiate training of an engineer. First, he needs to be continuously aware that he is entering a profession of which he can well be proud—that before him have gone many with high ideals, each of whom has raised the profession to a slightly higher plane than when he entered it.

Secondly, he needs to be instilled with the idea that this is not something for someone else to do—that each engineer as he enters the profession also has an obligation to leave the profession a little better than he found it—that this requires not only performing at his highest technical competency, but so conducting himself in his relationships with his employer, in his relationships with his community, in his relationships with organizations with which he may be associated, that all who come in contact with him appreciate that he is a professional man.

This obviously involves encouraging the student to become active in professional societies, in civic affairs, in service organizations, and in all the elements of social life which make

for a better community and a better country. As a professional person, it is not sufficient merely to put in the required hours of work and forget all other responsibilities. Finally, perhaps most important of all, he should approach his life's career with a firm recognition that the profession owes him not one thing—that he is honored to be accepted into the profession, but as a professional man he is duty bound to earn that honor; in short, he owes the profession far more than the profession will ever give him.

Now these past observations have been said many times in many ways. They are included in the writings of many professions; they appear often in admonitions and codes of behavior, not only for professional people but for human behavior in all of its aspects. The same basic elements appear frequently in writings of the major religions. Thus, I am sure there is no disagreement about the objectives.

Teaching Responsibility

Why then should we be concerned that our engineers do not have such professional concepts to the degree that many would desire? At this point I would like to be a little bit critical of teachers of engineering subjects.

Perhaps this is why we are giving attention to this topic at a meeting of engineering teachers—to try and focus attention of those to whom we entrust the training of the future members of the profession on a concept which can bring tremendous rewards in the future. I would like to mention three shortcomings in this area among our engineering teachers.

One, too many of our teachers teach their *subject* only. They feel that they are to meet a class for an hour on a subject such as electrical circuits, heat transfer, or reinforced concrete. They realize all too well that the time allocated to this subject is far too short to instruct the students adequately in the ramifications of the technologies involved, and they feel that the primary responsibility is to cover as much of the subject as possible.

Certainly no criticism can be directed toward this high objective. The difficulty is that because each teacher approaches his technical subject in the same way, our engineering graduate emerges from college with fine basic training in technology, but an alarming void regarding the profession about which he is to become a part.

A second, and closely correlated, observation is that most of our engineering curricula give little or no overall planning or attention to instilling professional concepts. Some of our more alert faculties have endeavored to provide a minimum of time for specific instruction in this area, but at most it appears that the time which can be permitted is one hour for one semester on such subjects as registration, ethics, employment conditions, business practices, and similar subjects.

Unfortunately, when such courses are introduced into the curriculum, this further increases concentration on subject-matters elsewhere, the first question I raised. Other teachers are then given the excuse of feeling that they are relieved of any responsibility in these areas.

All too frequently, however, the student is expected to get this information on his own. It is disturbing to many of us who have occasion to work with students, to find seniors attending professional meetings and completely overwhelmed that information on such items as unions and employ-

ment conditions exists. Why, these graduates ask, had no intimation reached them from their collegiate professional training?

A third criticism which might be leveled at certain educators is that they themselves do not set a very good example for their students. Undoubtedly membership in professional societies is higher among engineering faculty than among the engineering profession as a whole; yet a look at the membership of our own American Society for Engineering Education would indicate a considerable number of engineering teachers do not even belong to this organization so vitally concerned with their work.

The same is true, of course, of the technical societies and the professional societies. Too few of our engineering teachers have taken the trouble to become registered as professional engineers. Yet the majority of colleges, and all of the technical societies, will urge students to become registered as soon as they are qualified.

Frequently our teachers do not evidence any particular professional responsibility other than to meet their classes and concern themselves with the subject of their specialty. It seems unfortunate that deans of engineering and heads of department on occasion have to remind faculty members that it is to their own advantage to be active in society work and to recognize that they are continuously representing not only their university but the profession of which they are a part.

Suggestions

Criticism without suggestions for correction is indeed wasteful. I have the temerity, therefore, to suggest several that would seem to me to be beneficial in creating an atmosphere for students to develop professional concepts. Although I am sure our teachers are conscious of the fact, it seems worth while to emphasize again the degree to which they constitute the models for their students.

While it is true that for professional men the growing process never stops, psychologists tell us that the patterns of our further learning processes, and to a large degree the attitudes we carry through life, are deeply imbedded by the time we are twenty-one years old. Thus, the period of collegiate growth is a period of considerable molding for the future. Engineering college teachers have a tremendous opportunity to mold the embryonic professional in patterns of lasting benefit.

As a model then for professional behavior there are several items which he might check. One, he should act, talk, and encourage professional attitudes in all his contacts with students. Two, he should become registered and set the pattern of professional recognition. Three, he should join the societies of his major interests.

Certainly he should join ASEE for his interest in teaching, the technical society of his major course content, and his professional society concerning itself with the problems of all engineers. Joining societies, of course, is not sufficient unto itself. Societies are successful only to the degree of active participation by their members. Faculty members should establish for their students a pattern of membership and activity in engineering societies.

Secondly, teachers in all classes, regardless of subject matter, can emphasize professional concepts. This ranges from participating in a bull session on items of professional inter-

est to checking on the little things which are the difference between professional behavior and attitudes and those which tend to degrade the profession.

Let me give a specific example of the kind of thing which strikes me as being unfortunate. I recently was on one of our engineering campuses during their open house for the high school students of the state. This was a big event with thousands of guests being brought to the campus to inspect the engineering as well as the other educational facilities at this university.

The engineers, of course, were most anxious to impress these students and as a result had established just inside the beautiful wrought-iron front gate an exhibit destined to attract the student to engineering as he entered the campus. The choice of the exhibit, however, struck me as unfortunate, for there standing behind the transit was a life-sized figure of Abner Yokum, supposedly the epitome of engineering. There are many other little things which if ignored by the engineering teacher become a pattern of behavior which tends to create in the mind of the engineer of tomorrow that his profession is not held in very high regard even by his engineering teachers and students.

A third item which should receive more attention, and I realize there are many problems involved, is a suggestion to the deans and heads of departments that they give more thought to planning and over-all consideration of methods for instilling professional concepts in the students. One obvious way is, of course, to establish a course devoted entirely to professional conduct. Should this be the case, however, those charged with its administration should spend extraordinary effort to see that the remainder of the faculty do not feel they are relieved of responsibilities in this direction.

Frequent mention of this item to the faculty at faculty meetings, using instances which have occurred on the campus which both do and do not seem to be in the highest professional tradition, will help. Emphasis can also be placed on the practical problems the young man will face in his first work. Above all, a continuous atmosphere should be created in which the young man realizes that he is entering a profession of which his teachers are extremely proud, and in which he has a responsibility to carry the tradition to even higher levels.

I am sure no one questions the truism in the title of this paper "Upright Students—Upright Engineers," but upright engineers means more than just adherence to a Canons of Ethics or a creed; it means more even than high standards of professional practice. It means an attitude and a concept, and as the dictionary says, "A sense of duty and the character and authority of moral obligation."

Program for

MIDDLE ATLANTIC SECTION MEETING

Saturday, December 7—McGraw-Hill Book Co., New York City

Theme: Post-Collegiate Education

Morning Address: Post-Collegiate Education in an Era of Abundance

Afternoon Panel Discussions: Automation; Research and Development Education; Recruitment

---

WHAT THE TECHNICAL TEACHER CAN DO TO IMPROVE TRAINING IN WRITING SKILLS

CHRISTIAN K. ARNOLD

Staff Assistant to the President
The Pennsylvania State University, University Park, Pennsylvania

Presented at a Joint Conference of the English and Mechanical Engineering Divisions, 65th Annual Meeting of ASEE, Cornell University, Ithaca, New York, June 20, 1957.

Recommended by the English Division

Engineers *can* learn to write. Certainly, learning to write good, workmanlike, effective prose is no more difficult than learning to handle reasonably complicated mathematical disciplines. Yet all but the weakest engineering students learn to use basic mathematics with considerable proficiency in the long run.

Employers want their engineering employees to be able to write well. They list proficiency with language in every group of skills they draw up as desirable in the engineers they hire —often in first place and always high on the list. Many of them underwrite courses in basic and advanced composition for their engineers, and others pay top consulting wages to bring in people to conduct courses and seminars for them.

The enginers themselves find communication skills—or the lack of them —a determining factor in their careers. This fact is shown in many studies of the type recently conducted by the General Electric Company and in the popularity of technical writing seminars and short courses for practicing engineers such as we conduct in the summer at Penn State.

If engineers *can* learn to write, if the people who hire them want them to be able to write, and if experience teaches that the ability to write effectively is a significant factor in shaping a successful engineering career, why is it that most engineers do not learn how to express themselves accurately, forcefully, concisely, and interestingly? Why don't they learn to write?

I'm convinced there are two distinct and distinctly related reasons: (1) the engineering students, for the most part, do not feel the need to learn basic communications skills; and (2) neither do their teachers.

Let's go back to the analogy with mathematics. It's a fair analogy. Both are "service" disciplines. Both give the engineer basic tools he will need to use daily in his work and both, if properly taught and learned, contribute to the orderly, objective, systematic thought processes so essential to truly important engineering achievements and careers.

Mathematics

Before the engineering student starts his first course in freshman mathematics, he knows he must do well in it to succeed in his chosen profession. He has been told so in high school, and the importance placed on his high school record in mathematics through-

out the admissions procedure emphasizes it. After he gets in the course, his professor bases his teaching on the assumption that his is a critical course, that engineering success and mathematical proficiency go hand in hand with each other.

After he has completed the course, the student isn't allowed to forget what he has learned. He must take other courses based on the fundamentals he is now assumed to know. He will need to apply these fundamentals in other technical courses he takes, and lack of proficiency in their use will be reflected in the grade he receives. It isn't surprising, then, that the engineering student has developed considerable facility in the use of basic mathematics as a tool by the time he is graduated.

Communication

But how about communication? Well, our freshman has been pointing toward an enginering career for several years. Since "everyone" knows that English isn't particularly important to an engineer, he has tended to slight his high school courses in this area. In fact, his weakness in English may be one of the reasons he decided to become an engineer.

At the university or college, he finds he must take freshman English, usually taught not by a member of the engineering faculty but by a product of a liberal-arts college—often, of all things, by a woman. Our freshman is apt to ask his advisor or one of his other teachers (perhaps even his math instructor) why he must take this course. His answer is likely to be an evasive, ambiguous one that, boiled down into freshman language, means that the instructor doesn't know except that it is required. So the student takes it, passes it, and promptly forgets everything he learned.

Is he ever penalized for this forgetfulness? Of course not. His professors in advanced technical courses might occasionally complain generally about the inability of their students to turn out lucid, coherent papers and reports—or, more likely, about their inability to spell common technical terms correctly—but the grades received by the students seldom if ever reflect this inability.

If the information presented is accurate, the student gets a good grade —even though only a teacher familiar with both the problem and the student could wade far enough through the incoherent verbal maze to discover at last that the information was, in fact, accurate.

And must he ever use the information he supposedly learned in freshman comp in another course? Not until he needs to write a letter applying for a job—and in today's bull market, he can usually avoid even this possibility.

He may have to take an advanced course in report writing, but the odds are against it. And the teacher of the advanced course will start all over from scratch, unless he wishes to flunk nine-tenths of his class.

It's not surprising, then, that engineering students do not learn to write well. In fact, it's rather surprising that engineering graduates, as a group, learn to write as well as they do, which is just about as well as the graduates of any other professional discipline.

How To Improve?

What can the technical faculty do to change this situation? What can be the technical faculty do to improve

the writing skills of the engineering graduates, to raise the literary competence of engineering students?

The first and most important thing is to give active, positive support to the importance of developing effective writing skills, just as they now give support to the importance of knowing mathematics. Without the complete backing of the technical faculty, the English department is lost. Even the most fluent and persuasive English teacher cannot convince freshman engineering students that what he is trying to teach is important in a "practical" sense unless he has such support from colleagues in the technical departments.

To be able to give the sort of support I'm talking about, the professor of electrical engineering, for instance, will first have to be convinced himself —enthusiastically convinced. One way to become so convinced is for the professor to take advantage of one of the numerous summer programs industry is now offering where he must be responsible, if only for a short time, for the reports, manuals, and what-have-you turned out by junior engineers. But there must be other, less painful, ways to persuasion.

Second, he must establish certain minimum standards for the students' written work, and he must make it clear to the students that violation of these standards is just as serious as violation of the basic principles of mathematics. Certainly, the skill with which the material is presented should be reflected in the grade received for the work. A penciled notation that "this paper is very poorly written" carries no significant meaning to the student if he gets an "A" for it. By the same token, the student who does an extraordinary job with his written work should receive something more than a pat on the back in recognition of it. In other words, the instructor must *act*, not just give lip service to the premise that basic communications skills are expected of all people engaged in collegiate-level work.

Third, he must give the student, to a far greater extent than is now common, the opportunity to submit written work of the type that will be required of him after graduation. As you all must know, the engineer today is called upon to do a tremendous amount of paper work. He must write letters, memoranda, proposals, specifications, progress reports, status reports, summary reports, manuals, articles, and papers for all sorts of publics—his supervisor, other engineers in the same laboratory or organization, the chief scientist and the director of the laboratory, engineers who are specialists in the field written about and engineers who are not, the board of directors and the head of a military agency, the members of a technical society, and just plain people.

In all this writing, experience has taught that which common sense dictates: the best writing is that which is as simple and as clear as possible consistent with accuracy. Not one of these publics is particularly impressed by the writers' command of tortured, turgid technical jargon but all are deeply appreciative of a straight-forward, concise, well organized presentation made as simple as the subject matter will permit. Experience has also taught that these reports and other types of written work are the best advertising of a research and development laboratory or a consulting engineering firm; consequently, ability in this area is directly related to

promotion and advancement. It's just simple arithmetic.

The professors of technical and professional subjects, then, can help tremendously in preparing the engineering student for the job that is going to be required of him after graduation by giving him opportunities to develop skill and ability in this type of writing. After graduation, only those engineers stuck at the lowest possible level will be permitted the luxury of presenting information in any form resembling the objective-type quiz. I should like even to suggest that teachers of advanced courses should ask their students to write term papers in the form of articles for journals.

Further, I suggest that these papers should actually be submitted, and the grade received should be determined, at least in part, on the basis of whether or not the paper is accepted for publication in a recognized periodical.

If these steps were carried out systematically and energetically, there can be no doubt that engineering students would learn to communicate well. In fact, a program of this sort, carried out enthusiastically by the faculties of our engineering colleges, would soon make engineers the most literate of all professional groups in America today. It might even do away with technical editors and writers, who are now being paid more and advanced faster than engineers with comparable experience and education in many organizations.

Of course, I can anticipate certain objections to this program. The most serious of these is the fact that, to a certain extent, it makes the teacher of a technical subject serve, just as he now does in mathematics, as a part-time teacher of English or, at least, as a critic. How many of our technical faculties are qualified to do this? A very small percentage, I suspect.

But does this mean that the program is unworkable? I don't think so. Not if our engineering faculties want to make it work.

In the first place, I suspect that most engineering teachers are potentially better critics than they think they are. All that is basically required to bring out this potential is a change in attitude or point of view. A teacher familiar both with the student and the problem assigned him, who knows exactly what he is looking for, is hardly in a position to judge with accuracy the quality of the writing in which the answer is given. But all of us are capable to a greater or lesser extent of putting ourselves in the other fellow's place. We have to do it deliberately, but we can do it. The editor, in fact, must do it daily as part of his job.

If, then, the teacher will force himself to read the papers he grades not simply from the standpoint of the teacher looking for certain information from a particular student whom he knows well but also from, say the standpoint of just any authority in the field—an authority, that is, who does not know the author or the specific question and the required answer—he might be surprised at the objectivity he can achieve. He might also be surprised at the validity of the criticism he can make by forcing himself to take such a point of view. Further, he might be surprised at the insufficiency of some of the answers he had previously accepted without question.

In addition, if the student can learn basic communications skills, so can the teacher. There are several very practical avenues open to him if, again, he really wants to learn.

In the first place, writing skills can be self taught. In fact, this is the traditional way in which writing skills are acquired. There are many excellent books about writing, from basic freshman texts to books on advanced technical report writing and other specialized areas, such as the construction of charts and diagrams, the editorial handling of mathematics, and so forth.

Further, a growing list of articles on technical writing are appearing in journals and technical magazines. One magazine has even started a regular bimonthly feature on technical writing. To be of much value, these books and articles must be studied, not just read, just as you would have to study a mathematics text to get a really decent command of the subject it is trying to present. In fact, great gains can be made simply by studying the field enough to discover that writing is an exacting art that is not acquired automatically by learning to speak a language with reasonable facility as a child.

Or you can take a course. Industry and government are making extensive use of this method for their engineers. Three years ago, we offered at Penn State a two-week course in technical report writing for practicing engineers that covered about the same ground covered by a semester course in report writing. Its popularity has made it a fixed feature of the summer program for the College of Engineering and Architecture.

In fact, this year we are offering it twice in order to come somewhat closer to fulfilling the demand for it. Last year we took it on the road for the National Security Agency, and this year we have been asked by the David Taylor Model Basin to offer it just for their people. To date, about 150 engineers have taken the course—we limit enrollment to 40 in each class to permit individual instruction—only one of whom has been a teacher.

A similar program has been offered annually by RPI since one or two years before the course at Penn State was started. Last year, Harry Arader at Pennsylvania started a similar program, and MIT is offering one this summer, I understand. I suspect there are even others.

Or you could work out a mutual training program with your English staff. It has often been suggested that a closer working arrangement between the English department and the technical faculty would result in benefits to both. Certainly, learning something about engineering and the sort of work expected of engineers would help the English teacher to improve his courses.

In return, the English teacher could help the technical teacher learn something more about the principles and practices of composition. Again, arrangements of this sort are fairly common in industry and in research and development laboratories. Such mutual assistance could be worked out on a purely personal basis, it could be formalized through a series of seminars, or actual formal programs could be organized.

I must warn you that none of these programs will be of much help unless they are backed up with a great deal of actual practice. Probably no one ever learned much about writing without doing a lot of writing. Of course, this is not a difficult requirement to satisfy. Most teachers must do quite a bit of writing in carrying out their daily chores—interoffice memoranda,

class notes, tests and examinations, articles and papers. Most deans, I think, would welcome increased activity in the paper and article writing departments, in fact.

However, to provide a good laboratory for writing improvement, most teachers would have to spend a great deal more time on their writing than they now do. The act of dictating a test to a tape machine and having it transcribed by a secretary without any further revision doesn't help anyone to improve his writing skills. The kind of practice I'm talking about requires much revision and rewriting based on a deliberate attempt on the part of the author to put himself in the place of the intended audience. Writers call this empathy, and it's an absolute requirement for good writing, at least in the learning stages.

For maximum benefits, this practice will have to be accompanied by the acceptance of criticism. Good criticism is not hard to come by, if you really want it. You can learn a lot about your writing, for instance, on tests and examinations by studying the answers given not simply for content but also for signs of confusion on the student's part about what was expected of him.

Further, your colleagues, especially in the English department, will probably be glad to read your stuff and give you an honest appraisal of it if you convince them that you really want it. They will not, of course, if through your actions and responses, you indicate that what you really want is for them to tell you how good the stuff is. Most of them are polite people who will not want to hurt your feelings. And it's silly to bother them if you do not really want to know what they think.

In other words, if you want to improve your ability in and knowledge of writing, you are going to have to work at it, just as you would have to work at improvement in any other complicated art or discipline. At least two groups of publics will be extremely appreciative if you do: your students, who really do want to understand their textbooks, instruction sheets, tests, and examinations and the editors of journals, whose chief difficulty is that of finding enough decently written manuscripts to fill up their monthly issues.

Of course, there is nothing new in this program. At one time it was carried out as a natural part of all collegiate training. How many of you have recently read any technical writing written, say, in 1900? You should. You would probably find that it ranks with the best of journeyman prose. I suppose it was another victim of specialization. Whatever the cause of its disappearance, we need desperately to return to the old idea that the ability to handle language effectively is, *per se*, a part of the mental equipment of every educated person. If we insist that it is, it will be.

PETERSON DEAN AT UTAH

Dean F. Peterson, Jr., Professor and Head of Civil Engineering at Colorado State University, Fort Collins, has been named Dean of Engineering at Utah State University, Logan. Dean Peterson has been a member of ASEE since 1949.

WHAT'S BASE IN A BASIC CURRICULUM?

ROBERT L. ZETLER

Professor of English
Chatham College, Pittsburgh 32, Pennsylvania

Presented at a joint conference of the English, Electrical Engineering, and Mechanical Engineering Divisions, June 20, 1957, Ithaca, New York. Recommended for publication by the English Division.

To everybody concerned, the curriculum of a college or university is a fundamental thing. Part of this stems from the fact that it is concocted by a faculty with forbidding aspects, sitting on hard chairs. A more important part arises from the fact that a given curriculum represents a conscious attempt on the part of its builders to influence in some degree the lives of those students who are subjected to it. If we are a part of all that we have met, some of the basic matter that a curriculum sets down must necessarily rub off on even the most asinine of us.

Eventually, by a form of intellectual osmosis, the poison reaches the bloodstream, and the usual result is to produce some sort of antibody that results in our complete indifference to learning and to any sort of intellectual activity. (This always assumes that the planning of the curriculum has been organized on the prevalent philosophy that the professor is the natural enemy of the student and wishes him everything but well.)

In reality, it does appear that the builders of curriculums have come to their tasks with a rather curious attitude. (I here particularly refer to those courses of study given to unsuspecting engineering students, who it is widely known, approach the learning process with greater seriousness and more intense application than any other breed of college students.)

It sometimes seems that the artisans of curricula are very much like the exponents of horse-clubbing in Mr. Benjamin's story of the Saber-Toothed Curriculum. After all, if one is going out to club a horse for a late Sunday afternoon supper, he ought to think first as to which end he is going to club. If he approaches the horse from the front, there is clearly a danger that the clubber may be bitten; if he adopts a posterior approach, he may get kicked into the middle of next week.

"Horse" Curricula

Curriculum planners for engineering students appear to have adopted this rather negative philosophy as far as the study of English composition or literature and the humanities in general is concerned. They recognize that these are dangerous disciplines; students ought, according to some engineering professors, to creep up when such subjects are looking the other way and give them as ponderous a belt as possible, with the hope that they will thereafter be tractable at least, if not edible.

This school of thought is best represented by those engineering curriculums which place English composition in the category of (and I

quote this one literally) "required electives"—a phrase representing almost as much of mutual exclusiveness as "wealthy college professor"—and in which the freshman engineer is asked to take his only course in English composition. He is not asked to take it very seriously, and he is certainly not asked to take any more than that one course.

After all, there is no reason that a subject as simple as English composition and grammar cannot be mastered in two or three meetings a week for a semester. Engineers are intelligent, logical creatures, and they can be expected to carry on their own training in composition and literature if any further study should be needed.

The mere fact that they are engineers makes it abundantly clear that they understand the use of a logical outline scheme for whatever they do, whether it be a laboratory examination of the pH of a sample, the determination of the square root of -1, or the writing of a theme. Such a curricular scheme gives adequate time for the inculcation of the really necessary subjects—mathematics and the sciences. What's the difference if the student doesn't know how to read or write or talk? He can work a problem, can't he?

This curricular philosophy, which we should describe as the posterior approach (if we may return to our horsy analogy), does have certain weaknesses about it, none of which needs to be detailed to anyone who has attempted to give a refresher course to graduate engineers. The only thing refreshing about the whole performance is the abysmal ignorance of the unfortunate creatures who have been brought up under this discipline.

"Humane" Curricula

In opposition to those schools which scant and scamp preparation in English and the humanities in general, are those which recognize that an engineer must be able to communicate effectively; it is also apparent as one looks over the requirements in the engineering students' schedules in these institutions that their several curriculum committees have had a suspicion that graduates of their schools ought to know how to read as well as to write, for there are often requirements in English and world literature as well as in composition.

Such an approach is certainly looking the horse in the mouth; occasionally, some of these curricula go as far as to count his teeth. They prescribe surveys in English and American literature; they exhibit to the student courses in speech and composition; they offer specialized preparation for the writing of reports and articles of a technical nature. These courses are likely to be well taught by people who recognize their basic importance to the engineering student.

As a result, the graduate is usually a *literate* creature, even if an engineer. The tooth marks, of course, show on him—the time spent on these courses has taken away an opportunity for advanced study in mathematics or science. Or—and far worse—the fascination of literature may be so great as to lead the student away from the Solvay process, Laue patterns, and crystallographic planes and plump him into studying or even teaching the humanities.

The Apparent Dilemma

It now appears that I have managed to get myself into a logical box—

if an engineering school gives too much attention to the humanities, the student may be ill-prepared for his work. If, on the other hand, it does not give sufficient attention to the principles of communication, he will be graduated seriously handicapped into a world in which the old saw of "Hear no evil, see no evil, speak no evil" appears to have been varied into "Hear everything, see everything, yell like hell!"

Between the Horns—Or Ribs

From this bitter peroration, one might conclude that the answer is a sort of compromise. This is doubtful; one may drum for a long time on the ribs of our metaphorical horse without doing him any great amount of damage, for skill subjects require constant practice if they are to be kept effective. It seems most probable that this has to be a "heads-or-tails" approach, so we now might profit by attempting to find out what the basic difficulty in curriculum planning for engineers is.

Most engineering faculties have as their objective the preparation of qualified engineers. This is not, *per se*, a bad aim, even to those who, like myself, feel that the road to hell is paved with good inventions. But one may certainly question whether such an objective is not far too limited.

To become an engineer is clearly to win through to the greatest achievement that God may vouchsafe to mortal man. But it is evident that this achievement does, at the present time, ential an intimidatingly large host of sacrifices within other areas of knowledge and culture. There is simply not enough time to learn the thousand things that we expect an educated person to know, because that time has to be spent almost completely on the engineering disciplines.

The faculties of our engineering schools are quite aware of this, but most of them quietly confess that they can see no way to prepare a well-qualified engineer without at the same time producing a cultural imbecile. For instance, any one who has had a social as well as a work-day association with engineers will have observed the oddities of their parties.

The average social gathering of such people is likely to find the wives, pleasant and amiable creatures that they are, lined up on one side of the room talking about babies, the state of the rose garden, or the latest scandal in the missionary sewing circle, depending upon their ages and abilities. The men will be on the other side of the room, profitably engaged in discussion of one or another sort of mechanical contrivance.

An observer who was situated equidistant from both lines and capable of hearing both discussions might well conclude that the persons concerned came out that evening to get away from their spouses rather than to enjoy their society. (Of course, this may well be the true explanation, but one ought not to make the aim quite so apparent so early.)

"Professionalism"

I suspect that the center point of this problem lies, oddly enough, in semantics, the science of word meanings. Engineers have for a long time been proclaiming themselves as *professional* people, people whose courses of study and natural gifts are such as to allow them to enter that charmed circle. But being a professional person calls for a broad cultural education as well as extreme competence

within a given field, and engineering education simply does not give sufficient preparation to meet these two ends simultaneously.

It can and it does give the competence; it cannot, with the curricular limitations under which it now labors, give the culture. The engineer, with the usual four years of preparation above the high school, is attempting to edge himself by asseveration into a circle which usually calls for at least seven years of university work.

Some of the methods by which this move toward an unwarranted professional status has been forwarded are open to a good bit of ethical criticism. One of these, which, incidentally, has rebounded with sufficient force to cause many engineers to drop backward and experience about the same sensation that they would get from falling full length on an open set of carpenter's tools, has been the development of a technical jargon which no one outside the particular field can understand.

The rebounding effect to which I refer is that the engineer cannot communicate with any one outside his own field because his listeners cannot understand him nor he them. There's usually no point in talking to the man who does know the jargon, since he probably has the information already.

The ethical stricture which I would like to advance is that such a performance is intellectually dishonest; it is an attempt at obscurantism and obfuscation with an aim of increasing professional stature. It strikes me as being similar to the method which I think was employed by the psychologists and which I know was used by the so-called schools of education—the development of a specialized vocabulary, unknown save to the initiated, to describe common, everyday happenings, thus making the great unwashed think that here are people whose wisdom passeth understanding. Nor do I except my own field from this criticism, as anyone can see who examines the work of the "new critics" or who reads Mr. Faulkner's *A Fable*.

If you will agree (and I'm quite sure you won't) that to be a professional person asks more formal training than is now required of the embryonic engineer, it is reasonable to ask what kinds of training one should give him as he progresses through a curriculum designed to fill some *seven years* of collegiate work.

The Utopian Curriculum

In the first place, I would require a reasonable mastery of the arts of communication, nor would I allow a student to be graduated who showed himself to be markedly deficient in any of them. After all, any fool can learn English. Some of them even teach it after graduation.

Speaking well, as you have already noticed, is a good deal harder to learn, and some of us have become so entranced with the sounds of our own voices that we have never learned to listen. But in this counsel of perfection which I am outlining, the new professional engineer will be a master of reading, writing, speaking, and listening.

Next, I would organize a course to combine the major arts—the drama, literature, music, architecture, painting, sculpture—even the dance, for I have noticed when attending the ballet with friends of the engineering persuasion that they betrayed a considerable fear of an incursion by the police before the performance was

over. (They may well not have been misguided in this attitude, I confess.)

Within the framework of this course, I would require attendance at plays, both modern and classical, and the actual *purchase* (I almost tremble to advance such a heretical idea) of ten or fifteen volumes of novels and essays every year—and I'd make the students *read* them, too.

If the school is so located that it is possible, I would also require the in-person attendance at and hearing of ten symphony concerts every year. (Lest I be accused of saying that the engineering fraternity disapproves of music by having it pointed out to me that they are the primary exponents of hi-fi, may I say to those of you who are uninitiated in this subtlety that hi-fi is also an invention of the devil which has as its major requirement the turning up of the volume knob sufficiently so that the note of the French horn can be accurately differentiated from that of the bassoon at a distance of 3800 feet.)

As far as possible, the emphasis on the teaching of this course would be on the living arts, and not on the Sistine Chapel decorations or the measurements of the Parthenon. Further (and naturally, just to make the subject harder and more unpalatable), I would require the student to see the *correlations* from one art to another. I would expect him to observe that the young lambs which bound in Wordsworth's *Ode* are the same that leap in the third movement of Beethoven's *Seventh Symphony*.

Next, to add to the dismay and horror of the engineering student, I would ask him to take a course which combines the major ideas of psychology and physiology, and which would give him a secure basis for understanding what happened to him in his early years, and from which he may guide his own child as it grows. I would want him to understand that the love he felt for his sister when he was eight and the different attitude he had when he was eighteen was just as much a matter of the glands as of the clans.

And then, to encumber his schedule and to add a class at four-thirty in the afternoon when his only other one was at eight in the morning, I would urgently invite the engineering student's attendance on a course centering around the make-up of modern society, which would examine the place that religion, sociology, and economics hold in our world of today, and what we may expect them to do to us tomorrow. One item of immediate and practical interest that he might learn from this would be the maximum percentage of his income that he could safely mortgage by way of time payments.

Another upsetting requirement that I should like to add would be a course concerned with the integrated history of the modern world. This would not be a study of individual nations, but a correlation of their histories so that one could see the impact of nation on nation and the effect on the world of their varying policies and ambitions. I should expect a student to gather some ideas of tolerance from such a course, so that he would not carry into actual living the idea expressed in Mark Twain's statement: "I like an Englishman; I like an Italian; I even like a Frenchman if I can catch him doin' something that ain't indecent."

Finally, I should like to pry the engineering student into the subject which he knows he needs least of all —philosophy. Not the philosophy

which is concerned merely with the study of Platonism, Aristotelianism, Thomistic logic, the razor of Occam or the rhetoric of Duns Scotus; but instead a study of a philosophy which shall tell how to organize past experience into future happiness.

Not a philosophy which is primarily concerned with cause-to-effect relationships, but one which shows (*miserable dictu*) that casual relationships ought to be regarded with dubiety. Although it is fundamentally true that a cat which has seated itself on a hot stove lid will never again sit down on a hot stove lid, the kind of philosophy which the engineering student must learn as a basis of life is that that cat will never sit down on a cool stove lid either.

Such a course in the organization of experience consists of a great deal more than the mere ordering of a syllogism or the incorporation into life of mathematics and pure logic. The fact that

$$\text{"pq} - \text{qp} = 2\pi/2\text{h"}$$

sounds like nonsense does not make it so. The intervening of the time allows an item which is stable today to be antic tomorrow. The new philosophic study advanced in this plan for student perfection is not, then, one which will be merely a gloss on the works of the ancients, but one which will show the symbolic relationships between yesterday, today, and tomorrow.

This is not to suggest that Buddha and the Bhagavad-Gita or Confucius and the Koran should not be examined, but that their philosophies ought to be integrated into the framework of modern life as well as into what may be anticipated for the future, far as human eye can see. Although time past and time future are contained in time present, it takes a deal of doing even for T. S. Eliot to separate these three.

Such a course in philosophy, which is to integrate past knowledge and an anticipation of the shape of things to come, is the only one with which the student of science should have concern. That it will keep his mind off his other troubles is practically certain; that from it he might come to a time when the wicked cease from troubling and the weary are at rest is less likely—but the best of curricular intentions often turn out drolly.

These and a thousand other small deliberations ought to bring enough of an outcry from engineers so that I should be buried under mountains of abuse. My only apology is that I can't help it, for I suspect myself to be a professional missionary and reformer—the kind of person to whom, of course, no one should attend at all seriously.

SHAVER NAMED DEAN

Professor Robert E. Shaver, Head of the Department of Civil Engineering at the University of Kentucky, Lexington, recently was appointed Dean of Engineering there. On the faculty since 1931, Dean Shaver has the distinction of serving under all the previous Deans the College of Engineering has had. He has been a member of ASEE since 1943.

EDUCATIONAL USE OF NUCLEAR REACTORS

Report of the ASEE Session at the EJC Nuclear Congress

Abstracts prepared by

CHARLES F. BONILLA

Professor of Chemical Engineering and Chairman of the Nuclear Engineering Committee, Columbia University. Member, ASEE Nuclear Committee

On March 11–15 the 1957 Nuclear Congress, coordinated by Engineers Joint Council, took place in the Convention Hall in Philadelphia. The ASEE sponsored the session on March 11, at which eight papers describing six different types of educational and research reactors and several subcritical assemblies were presented.

Paper 1) The "Water Boiler" as an Instructional Tool. C. K. Beck, U. S. Atomic Energy Commission, Washington, D. C. (57-NESC-85)

Paper 2) Educational Uses of the Small 5-Watt Laboratory Reactor. J. W. Flora, Atomics International, Canoga Park, Calif. (57-NESC-73)

Paper 3) The Portable Polyethylene-Moderated Training and Research Reactor (AGN-201). A. T. Biehl, R. A. Fayram, M. M. Harvey, G. A. Linenberger, J. D. Randall and M. C. Reder, Aerojet-General Nucleonics, San Ramon, Calif. (57-NESC-110)

Paper 4) The Thermal Test Reactor and Its Applications. H. B. Stewart, G. B. Gavin and R. E. Slovacek, Knolls Atomic Power Laboratory, Schenectady, N. Y. (57-NESC-112)

Paper 5) Reactor Experiments in ORSORT. Herbert Pomerance, Oak Ridge School of Reactor Technology, Oak Ridge, Tenn. (57-NESC-74)

Paper 6) Reactor Experiments at ISNSE-The Argonaut (part 1). R. H. Armstrong, C. N. Kelber, D. H. Lennox and B. I. Spinrad, The Argonne National Laboratory, Lemont, Ill. (57-NESC-75)

Paper 7) Reactor Experiments at ISNSE-Subcritical Assemblies (part 2). Harry Bryant, Argonne National Laboratory, Lemont, Ill. (57-NESC-75b)

Paper 8) Educational Uses of the "Pickle-Barrel." R. M. Stephenson, New York University, University Heights, New York. (57-NESC-105)

Separate reprints of papers no. 1, 2, 3, 4, 5, 6 and 8 will be available until January 15, 1958, at 30 cents each through the ASME Order Department, 29 West 39th Street, New York 18, New York.

The following comments on the principal instructional reactor types are based in the main on the papers presented. They are provided for interested ASEE members who were unable to attend the session.

The "Water-Boiler"

(*Paper 1*) The first reactor to be used in university teaching employed a homogeneous aqueous solution of enriched uranyl sulfate ($U^{235}O_2 \cdot SO_4$)

in a 12-inch spherical "core" surrounded with a thick layer of pure graphite as a neutron reflector. Located at North Carolina State College, it has carried a heavy research and teaching program. It does not actually boil the solution, but rather gets its name from the continual radiolysis of the water to hydrogen and oxygen, similar to boiling if it could be seen. Maximum possible power capacity is some 10 to 50 thermal KW, but 500 watts is a more popular power level for routine operation.

This type of equipment has several specific favorable instructional features:

a) By installing, in the core, cooling coils through which hot or cold water can be circulated, the core temperature can be varied independently of the power level. The position of the control rods to obtain minimal steady operation at low power can then be determined at various temperatures. The hotter the solution, the larger its volume and the slower the absorption of neutrons by the U-235, and the farther the control rods have to be pulled out to compensate for these two effects.

The (negative) temperature coefficient of the liquid-phase core is then calculated, using a previously-obtained calibration of the control rods. Repeating at high power, the "void coefficient" due to the gas bubbles formed is obtainable. This quantity is particularly significant in the design of true boiling reactors.

b) Since the critical volume of this type of reactor is small, the core approximates a point source. The profiles of the gamma, fast neutron, and slow neutron beams can be measured, and changes in the beams on insertion of different absorption or scattering materials and on start-up or shut-down can be observed.

c) Since the fuel is in a liquid solution, the radioactive fission product gases, such as the several isotopes of xenon and krypton, can be collected and used as a strong gamma radiation source. They will be substantially free of neutrons and will thus not radioactivate the materials irradiated. Furthermore, studies of fission product behavior in general can be carried out effectively.

The water boiler serves primarily as a source of beams, and is thus valuable for research which leans more towards physics than is the case with other reactors. At atmospheric pressure the power is limited to about 50 KW due to the gas evolution, which amounts to some 300 ml./min. for each KW. However, the device has proved itself as an educational and research reactor, and a full year of over two dozen valuable laboratory experiments can be readily carried out with it.

Water boilers cost about $175,000 exclusive of the building, and a number of companies stand ready to supply them. Though designed to be fool-proof, with potential power in the killowatt range they would from normal prudence not be installed in a general university building, but rather in a special nuclear laboratory.

The Low-Power "Water Boiler"

(*Paper 2*) Atomics International, a division of North American Aviation, has recently offered for $55,000 a 5-watt version of the water boiler, suitable for installation alongside other instructional facilities. As shown in Figure 1, this reactor incorporates a

modified water boiler core, encased in 6 inches of lead serving as a reflector and primary gamma shield.

The fuel solution contains some 1200 gm. of U-235. The core-reflector assembly is located in an eight-foot tank of water, which slows down and reflects the fast neutrons escaping the core. The water contains a dissolved borate, since boron is a strong absorber of neutrons once they have been slowed down, or "thermalized." The water serves also as additional gamma shielding and as a temperature stabilizer for the core.

A distended cap on top of the core contains a catalytic H_2–O_2 recombination unit, and a temporary regurgitator catch-basin for fuel solution expelled from the core if a power excursion occurs. Small drain holes permit the solution to run back slowly to the main vessel. Two cadmium cylinders are moved down vertically in sleeves through the sphere wall to act as control and safety rods.

In the central "glory hole" exposure tube, 1.18 inches in ID, the neutron flux reaches 10^8 neutrons/cm.^{2} sec., and the gamma intensity 1000 Roentgens/hr. Four smaller exposure tubes are provided for activating wires in the core to determine the neutron flux distribution, and for other experiments requiring minimum volume. Two hollow 3-inch beam tubes are provided through the water to allow neutrons and gamma rays to issue for external experiments.

The control and safety rods are moved automatically by small motors on the top of the tank, controlled by the power detecting circuits, by a high gas-pressure monitor, and by a safety interlock network. A selsyn repeater system indicates the control

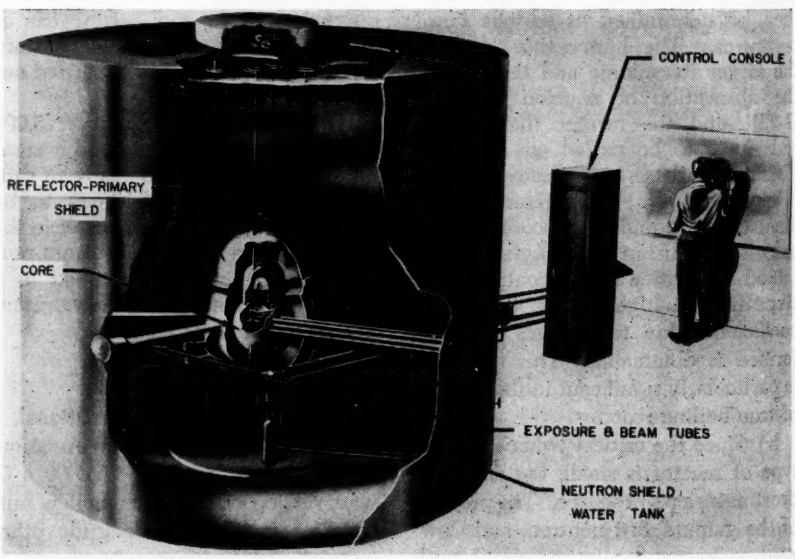

FIG. 1. *Cut-away view of the Atomics International low-power water-boiler laboratory reactor. The fuel is an aqueous solution of enriched uranyl sulfate.*

rod positions directly on the control console panel.

In general, this reactor can handle most of the experiments feasible with the high-power water boilers, except that all beam intensities and specific activities produced are only 1/1000 as strong. In addition, temperature coefficient studies might be difficult, as they would seem to require heating the whole tank of water, unless some thermal insulation is provided around the lead. However, for a limited investment it provides good value consistent with good safety.

The Low-Power Homogeneous Polyethylene-Moderated Reactor

(*Paper 3*) Aerojet-General Nucleonics is offering a "mass-produced" low-power instructional reactor, designated the AGN-201. The core contains a 9.5-inch pile of 10-inch disks of 20% enriched UO_2 powder uniformly dispersed in radiation-hardened solid polyethylene, of some 200° C. melting-point, serving as moderator. Eight inches of graphite reflector, four inches of lead shielding, and two feet of borated water in succession surround the core, as shown in Figure 2. The normal power is $\frac{1}{10}$ watt, but operation at 5 watts is permissible with an additional 20 inches of concrete shield.

Base price of the reactor is $95,000, much of the additional cost over the previous reactor being attributable to design for extreme safety and foolproofness. For instance, the use of a graphite reflector inside of the lead shield keeps the required amount of

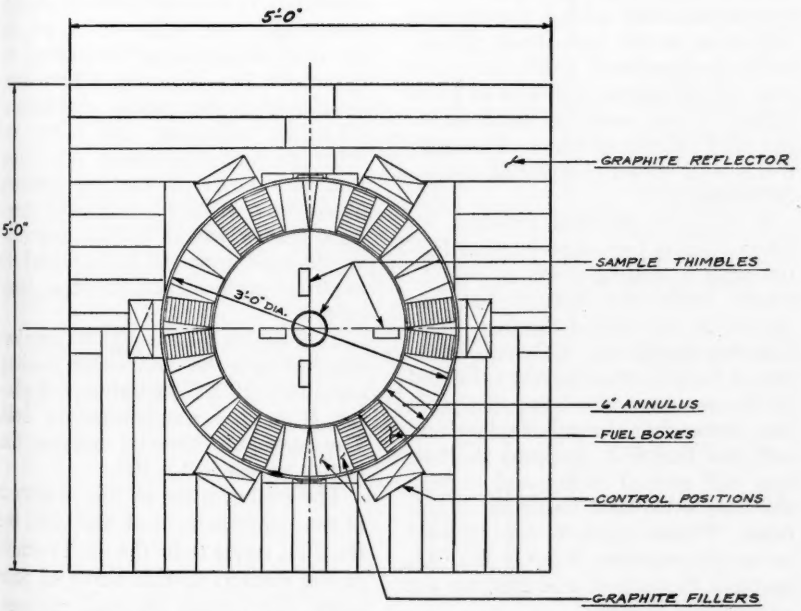

FIG. 2. *Cross-section through the Aerojet-General Nucleonics AGN-201 low-power nuclear reactor. The fuel is a dispersion of enriched UO_2 in solid polyethylene.*

U-235 to the relatively low figure of 600 gm., though at the expense of an increased weight of gamma shielding.

The control rods contain fuel rather that neutron "poison," to save fuel (this means that removing the rods shuts-down the reactor, (rather than vice versa). Furthermore, four control rods are used. The power level control and monitoring circuit is in duplicate, and a separate circuit shuts down the reactor if the e-folding power period (the time for the power to increase each e times) falls to less than three seconds.

This core also has a high negative temperature coefficient of reactivity ($-0.00036/°$ C.), so that an "accident" in which the total available 0.19% of excess reactivity was slowly added unintentionally would only cause a temperature rise of 5° C. If it were suddenly added, the thermal expansion would take about ⅕ second to be completed, and in the meantime a total power excursion of some 1700 KW. sec. and core temperature rise of 70° C. would ensue. However, this is well within permissible operating limits.

In addition, there is provided an integral safety fuse—a polystyrene button with a melting point of 100° C. which holds the bottom half up against the top half of the core. This fuse has double the UO_2 concentration of the polyethylene and is located in the center of the core, so that it runs hotter than the polyethylene and will give way first, dropping the bottom half several inches and making the core subcritical under all conditions. Fission products are retained in the polyethylene, if not in the UO_2 particles themselves, and thus are not appreciably liberated.

A complete list of experiments has been worked up by the manufacturers. Though somewhat less flexible than other reactor types, the AGN-201 is worth serious consideration for circumstances in which the utmost in safety is the prime objective. Many schools have already requested this type of reactor in their AEC grant proposals.

The Thermal Test Reactor (TTR)

(*Paper 4*) A useful shape for a nuclear reactor is that of a hollow cylinder of fuel elements, both enclosing and surrounded by moderator and reflector. Through the Knolls Atomic Power Laboratory, the General Electric Company announced such a design in 1952.

The primary objective was a high sensitivity to thermal neutron absorbents, which was achieved by placing the test samples along the axis of the cylinder. For instance, TTR's have been used for the routine checking of all tubes, rods, nuts and bolts, and other components before incorporation into large production reactors. Frequently, mislabeled or stray items have been rejected in this way that would have appreciably impaired the neutron performance of the large reactor.

The design of the TTR employs graphite reflector and water cooling, permitting 10 KW operation and placing it in the medium-power field. The maximum thermal neturon flux at this power is 3×10^{11}.

The selling price of this reactor is in the neighborhood of $300,000, but the TTR seems to be the most suitable of the reactors in this size and price range for precise physical measurements. For instance, thermal neutron

absorption cross sections can be measured with an accuracy of 1%.

Fission parameters such as the average number of neutrons liberated per fission of the uranium and plutonium isotopes, neutron "temperature" or energy vs. position in the reactor, and resonance integrals and self-shielding of strong resonance (high neutron energy) absorbing elements have been measured in the TTR. Other standard operational problems present no difficulty, so that this reactor is highly suitable for the training of reactor physics students as well as for certain types of precise research.

The Argonaut

(*Paper 6*) The Argonne National Laboratory recently selected the TTR principle for general instructional and calibration needs in its International School of Nuclear Science and Engineering. The design changes made, however, justify the selection of a new name, the Argonaut. The last four letters are stated to represent "nuclear assembly for university training," though one suspects, as in other similar cases, that the name may have preceded the title it abbreviates? Figure 3 shows the layout of the annulus and the 12 fuel boxes.

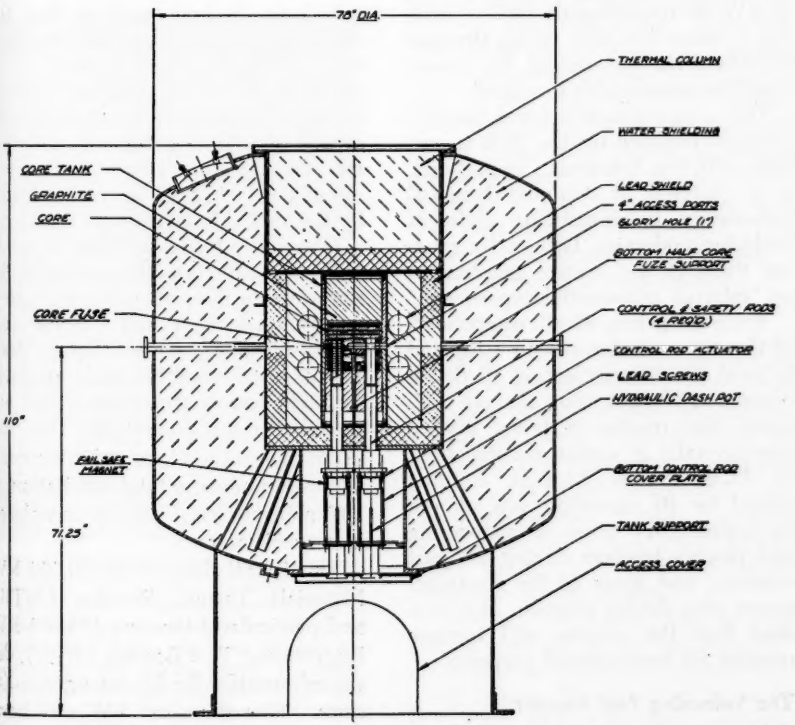

FIG. 3. *Top view of Core Region of the Argonaut. The coolant is deionized water, which flows upward between the vertical U_3O_8-Al plates in the fuel boxes.*

Basically, the Argonaut is a 5-ft. cube of graphite. Besides the inner and outer reflectors, the space between the fuel boxes is filled with rectangular and triangular prisms of graphite, to minimize the space filled with cooling water, and thus the neutron losses.

The fuel is 20% enriched U_3O_8 in an aluminum matrix formed into plates 0.096 inch thick and about 3 × 24 inches in size. Seventeen of such plates are assembled in a box jig and interconnected with aluminum screws to form one fuel box. The loading is about 4000 gm. of U-235, and at the allowable short term power level of 10 KW the maximum thermal neutron flux is some 5×10^{11}. With stronger forced-convection cooling the power could be considerably increased.

The same instructional and research program outlined for the TTR is possible with the Argonaut. In addition, it is planned at Argonne National Laboratory to investigate different fuel-plus-moderator lattices by placing them in the central graphite as an "internal exponential experiment."

Accurate prices of all components of the Argonaut have been estimated to total $80,000, neglecting all development and engineering charges. Already this reactor is being offered commercially in various modifications at $170,000. A 12-week training school for its operation was offered by Argonne to a group of engineering and physics teachers during the past summer, and some of the manufacturers plan similar schools. It is evident that this reactor will become popular for instructional purposes.

The Swimming Pool Reactor

(*Paper 5*) For the last several years the most popular instructional and small research reactor has been the swimming pool type (SPR), so-called because it is placed under some 20 ft. of water in an actual "swimming" pool. The safety concept involved is embodied in the statement that "water has no cracks"—through which radiation might leak.

This type was first developed as the 10 KW Bulk Shielding Facility reactor (BSF) at the Oak Ridge National Laboratory. Elaborate shields could be set up in one compartment of the pool, then tested by flooding with water and moving the reactor core from the other compartment to serve as a source of radiation.

It soon became evident that the BSF also was an admirable teaching device, because the fuel boxes (similar to those of the Argonaut) could be moved around under the water by means of a long pole, and different core arrangements could be observed visually (see Fig. 4) as well as tested by the available instruments.

It was also found out that on going from natural convection cooling by the water in the pool to strong forced convection with an external pump and heat exchanger, powers up to 5000 KW or more could be safely attained. At such powers the neutron flux approaches useful magnitudes (i.e. 10^{14} neutrons/cm.^{2} sec.) for radiation damage experiments; a total irradiation of 10^{20} neutrons/cm.^{2} can be completed in a week or two.

This is still short of the 30,000 KW Materials Testing Reactor (MTR) and particularly the new 175,000 KW Engineering Test Reactor (ETR), designed specifically for strong irradiations. Five thousand KW are, however, ample for most such tests and for creating extremely strong radio-

active samples for other research applications.

A number of concerns are offering SPR's on the market, and the price ranges from a minimum of about $250,000 up to several times that figure when equipped with fullest instrumentation and designed for high power.

The Pennsylvania State University and The University of Michigan, as well as several foreign countries, have acquired reactors of this type. Also, Columbia University will supervise operation of the 5,000 KW Industrial Reactor Laboratory (IRL) for the American Machine and Foundry Company and nine other cooperating companies. The SPR will apparently remain popular among the higher-priced educational reactors.

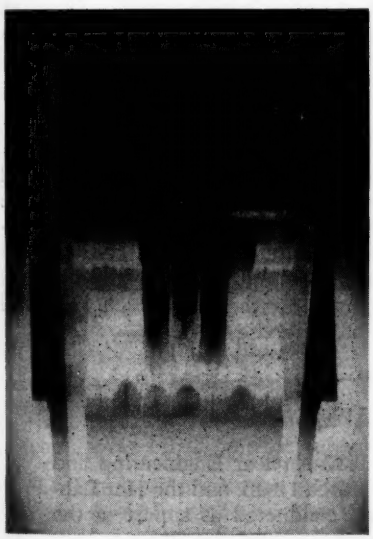

FIG. 4. *View of the core of the swimming pool reactor at Oak Ridge in position under 15 feet of water. The vaguely-seen boxes at the bottom are the assemblies of fuel plates. Immediately above are three control rod guides, and still higher several "counters" that indicate the operating power. The core is self-illuminated by the Cerenkov radiation from fast electrons whose velocity exceeds that of light in the water.*

Tank Type Reactors

This designation is usually given to water-cooled reactors of higher power than the SPR's (such as the MTR), or to heavy-water-cooled reactors of similar design, in which the core is bolted into a tank to obtain more positive coolant flow control or, in the latter case, to avoid loss and dilution of the D_2O. These reactors generally cost upwards of $1,000,000 and lose the educational advantages of the visibility of the SPR and the simplicity of some of the other types. However, Massachusetts Institute of Technology in completing a heavy-water tank-type-reactor, and some other institutions may follow suit if funds can be raised. The tank type is especially useful because of the larger volume obtained at a given power and neutron flux, and accordingly the larger number of simultaneous research projects that can be accommodated.

The "Pickle-Barrel"

(*Paper 8*) Subcritical assemblies are similar to critical reactors, except that they generally are smaller and require a neutron source continously to develop any flux whatsoever. The flux is also insignificant compared to that obtainable in any critical assembly. In spite of the low fluxes, however, many valuable instructional experiments can be performed.

Currently the most popular subcritical assembly is the "pickle-barrel," developed at NYU and already supplied to some 20 other institutions by the AEC under its loan program. The name comes from one possible

type of tank for the water serving as moderator. The fuel assembly consists of some 2.5 tons of one-inch natural uranium slugs in aluminum cans eight inches long inserted into slightly larger vertical aluminum tubes, positioned, in the optimum arrangement, on triangular 1.78 inch centers.

A plutonium-beryllium or other neutron source is placed in the central tube and fissions U-235 in the surrounding uranium slugs, multiplying the total number of neutrons by a factor of about 10. Although not adequate for strong activations, the "pickle-barrel" is quite satisfactory for obtaining neutron flux distribution curves, determining the migration length of neutrons in the lattice, observing the temperature coefficient by heating the water, changing the metal-to-water ratio by varying fuel element spacing, checking the flux perturbation on inserting simulated control rods, and even studying reactor kinetics by pulsing the neutron source.

In view of the high cost of the uranium and the neutron source (over $100,000) it is not likely that the "pickle-barrel" could normally compete with the critical reactors previously described. However, in view of its availability on a free loan basis it will certainly be a valuable aid in the country's nuclear instruction.

Graphite Sub-Critical Assemblies

(*Papers 5 and 7*) Graphite-moderated sub-critical assemblies are well-known by now, since the first one was built in the early 1940's to provide lattice parameters for the Hanford reactors. As presently used, such assemblies range from four to eight foot cubes, and the graphite, at about $1, per pound after machining, makes their cost some $10,000 to $25,000 over that of the "pickle-barrel." However, the graphite-modulated units will remain popular for instructional purposes.

Summary

An impressive array of instructional and research reactors is now available to American universities. The benefits to be derived from these facilities are only limited by the ingenuity and persistence the staffs which will install and supervise them.

1957 NUCLEAR CONGRESS PAPERS

The individual papers from the 1957 Nuclear Engineering and Science Conference in Philadelphia, March 11–15, and the Hot Laboratories and Equipment Conference, conducted as a part of the Congress, will be available until January 15, 1958, for 30 cents each from the ASME. They fall under the following headings: Coolants, Educational Use of Reactors, Fuel-Cycle Economics-Production-Recovery, Heat Transfer and Heat Evaluation, Instrumentation, Merchant Ship Safety, Metallurgy and Radiation Effects, Natural Resources, Plant Components, Plant Containment Concepts and Design, Protection of Water Supplies, Radiation Processing, Reactor Design-Operation-Maintenance, Shielding-Structural Protection and Control of Fission Products, and Waste Disposal. For a complete listing of titles and authors, write to the American Society of Mechanical Engineers Order Department, 29 West 39th Street, New York 18, New York.

TEACHING AS AN EXCITING CAREER

M. STANLEY HELM

Professor of Electrical Engineering
University of Illinois, Urbana

Foreword: At section meetings this spring I urged that engineering faculties should take occasion to tell students why we find teaching the most rewarding and exciting area in which to practice our profession.

Last year I conducted a number of Coffee Hours with students at Illinois where, with a colleague or two, I led discussions on such topics as Professional Conduct, Engineering Society Organization, Registration, Relation of Psychology to Engineering, Research, and so forth. In order to practice what I preach, one of the topics chosen was "Teaching as an Exciting Career." I was delighted and, I must admit, somewhat surprised to have the best student attendance of the season for this particular session. Professor Helm, who was my partner on this occasion, made such interesting points that I asked him to present them in a paper.

W. L. Everitt

Most engineers and engineering students do not realize that engineering teaching is a fascinating, stimulating, and exciting career. Perhaps this is a result of not having applied the "engineering method" in an evaluation of engineering teaching as a career. Accordingly, an attempt is made here to analyze engineering teaching, pro and con, in much the same way one would any other profession.

Advantages of Teaching

There are several advantages to teaching over other possible careers:

(1) Teaching offers the opportunity to serve mankind in the very important matter of training young people to find a place in and make contributions to society. Few, if any, positions are more important to the welfare of the nation. The effect of this responsibility on the teacher is to produce a day-to-day stimulation which contributes to a satisfaction and happiness in his work that cannot be realized if money is the only driving force.

(2) Teachers are able to work with young people and hence are continually exposed to fresh viewpoints and vital enthusiasm. This is stimulating to the teacher and adds zest to everyday living. Associating with students is the best way to stay young.

(3) Teaching affords freedom to follow one's own intellectual bent and to satisfy one's curiosity. At a university it is always possible to carry forward individual study projects which require specialized library and laboratory facilities, some leisure time for contemplation, and the help of inquiring minds from many fields of endeavor. Many research projects can obtain financial help from government and industry—which means compensation for following up one's own interests!

(4) A teacher's working hours are not as rigidly scheduled as in most other professions. After classes are

met, preparation, grading, study, research, and writing can be fitted into a time schedule largely to the best advantage of each individual. Teachers have many responsibilities outside the classroom, but there is a certain flexibility in handling many of them which cannot be found elsewhere.

(5) Traditional "vacations" during the school year and the periods between terms or semesters offer a break in the daily routine of meeting classes. Although there is plenty of work to be done during these periods, the change in the everyday routine does much to prevent a feeling of being in a rut, and creates additional enthusiasm for the job ahead. Also, the summer months between the spring and fall terms offer the teacher opportunities to do many things outside of teaching, including travel, research, writing, and work in industry. One of the most fruitful of these opportunities to the engineering teacher is industrial work because of the association with the many fine engineers who contribute so much to mankind.

(6) A teaching position offers more stability than most jobs do. Even in times of economic depression the usual effect on teachers has been minor salary reductions, whereas in industry an all too general occurrence has been termination of projects and even of employment. The process of education must go on whether the times are economically good or bad.

(7) In teaching there are opportunities to do consulting work, which not only augments a teacher's income but furnishes excellent material to bring into the classroom.

(8) The cultural, educational, and allied activities in a university town constitute an excellent environment in which to live and raise a family.

Disadvantages of Teaching

There are a few disadvantages to teaching which must be mentioned, however:

(1) In general, teaching salaries have always been lower than those the teacher could command in industry. A 1956 Engineers Joint Council survey shows that the average salary of engineering teachers is near the average of the engineering profession when all sources of teacher's income are included, such as consulting fees and royalties.

The same survey indicates, however, that teaching salaries need to be raised when consideration is given to the fact that they are lower than those of practicing engineers from the upper scholastic and advanced-degree brackets, the groups which produce most teachers. Nevertheless, it does not appear that permanent vows of poverty and privation are required of an engineering teacher who is willing to extend himself and work with dedicated vigor.

(2) There is considerable unpleasant routine work concerned with the general process of grading and evaluating students. Quizzes, reports, and examinations must be carefully and fairly gone over with constructive comments made if they are to be instructive to the student. In many cases the determination of the final grade in a course is a disagreeable job, particularly when it is necessary to mark the student unsatisfactory. In such a case the teacher always wonders where he himself has "failed" the student.

Challenges and Rewards in Teaching

Many of the rewards in teaching come from the stimulation and fas-

cination afforded by the challenges encountered in the teaching process. Perhaps one reason that teaching is so stimulating is that engineering teachers work not only with inanimate problems, but also with the *minds* of students. The resulting challenges and rewards in teaching are:

(1) Each student and each class challenges the teacher anew to accomplish the objectives of a course. Students differ enough in personality and mental makeup so that the same material can seldom be taught in the same manner. Every session of a class poses fresh problems, never quite the same as those met before. As a result, it is difficult for a teacher to "get into rut," popular belief to the contrary notwithstanding.

(2) One of the most difficult and yet fascinating of all of the problems in teaching is that of inspiring and prodding each student to extend himself as much as possible without destroying his self-confidence. Assigned tasks must always require that the student exert himself fully, must "stretch" mentally and creatively to complete them. Yet at the same time the problems must not be impossible or seriously beyond his grasp or level of maturity if his self-confidence and self-reliance on his own ability to learn are not to be impaired. Each student presents a slightly different problem in this respect and must be carefully, sympathetically studied as an individual. This is a real challenge and a constantly troubling responsibility for the dedicated teacher.

(3) The most fascinating and rewarding part of teaching is watching the growth of a student's mental ability and personality. Just to see a student's face "light up" when he is finally able to grasp a difficult point is worth all the patience and effort a teacher must expend in attacking a problem from varied viewpoints in order to reach the student. It is especially satisfying for the teacher to observe the development of a student and a class or classes as the school year moves onward, particularly if the teacher feels that he is contributing at least partially to this growth by the way he guides, encourages, and pushes the student and the group.

(4) One of the most soul-warming long-range aspects of teaching is the pride and satisfaction a teacher realizes when a former student is successful and takes on responsibilities in industry and civic life. A teacher receives a new sense of dedication when he is told that he has helped one of his students prepare to take his place as a useful member of society, especially when the students themselves return on purpose to express their appreciation.

Characteristics of a Good Teacher

At this point it might well be asked, "But what type of person will find teaching such a stimulating, fascinating, and exciting career?" The characteristics of such a teacher are briefly summarized below, this list being based on several years association, both as a student and as a colleague, with many fine teachers. A teacher needs:

(1) The ability and desire to explain things to others.

(2) An analytical type of mind.

(3) The ability to think quickly while standing before a class.

(4) Patience and emotional stability.

(5) A cheerful, optimistic view of

life, with a full, rich sense of humor but no trace of destructive sarcasm.

(6) The ability to inspire others.

(7) An appreciation of the viewpoints of others, and the courtesy to listen to their ideas.

(8) An appreciation of and interest in the problems of young people.

(9) Fairness in the treatment of all students in every respect.

(10) Intellectual honesty in admitting an error or the inability to answer a question without further study, but the ability to err infrequently.

(11) A sound knowledge of subject matter.

(12) A speaking voice and general personality in presention which is clear, understandable, well projected, pleasant for listening, and free of annoying mannerisms.

Conclusion

It has been said that the "proof of the pudding is in the eating." The proof that teaching is fascinating, stimulating, and exciting is evidenced finally by the fact that the dedicated teacher looks forward with a kind of inner excitment to the start of each working day.

H. A. PETERSON RECEIVES AWARD

Harold A. Peterson, Professor and Chairman of Electrical Engineering at the University of Wisconsin, Madison, recently was given the third annual Benjamin Smith Reynolds Award of $1000 for excellence in the teaching of future engineers. The award was presented at a dinner which climaxed the University's ninth annual Engineers' Day program. A member of ASEE since 1947, Professor Peterson personally initiated five advanced courses of study in his department, and took an active part in developing the program leading to the master's degree for students working at the University's Milwaukee area Division.

MIES VAN DER ROHE HONORED

Ludwig Mies van der Rohe, director of the department of architecture, Illinois Institute of Technology, Chicago, and a member of ASEE since 1954, has been awarded Germany's highest honor in the fields of science and art, the Order Pour la Merite. Only 39 men from all over the world are chosen to hold these lifetime memberships in the Order, which was founded in 1740 by Frederick the Great. A leading exponent of contemporary architecture and design, Mies evolved the master plan for Technology Center, the name given Illinois Tech's new campus on Chicago's near South side. He also is responsible for design of the Seagram's building in New York City and for twin 26-story apartment buildings on Lake Shore Drive in Chicago.

Preliminary Listing of

SOCIETY COMMITTEES, 1957-1958

ANNUAL MEETING: C. A. Brown, *Chairman*, General Motors Institute, Flint, Mich.; W. L. Collins, Walton Forstall, J. C. Gebhard, E. D. Howe, Glenn Murphy, M. P. O'Brien, W. I. Short, G. R. Henninger, L. M. Vallely.

AWARDS POLICY: N. W. Dougherty, *Chairman*, University of Tennessee, Knoxville; W. T. Alexander, H. O. Croft.

CONSTITUTION AND BY-LAWS: K. F. Wendt, *Chairman*, University of Wisconsin, Madison; H. H. Armsby, H. O. Croft, L. K. Downing, L. E. Grinter, H. P. Rodes.

CURTIS W. MCGRAW RESEARCH AWARD: (See ECRC for committee personnel).

DEVELOPMENT OF ENGINEERING FACULTIES: H. L. Hazen, *Chairman*, Massachusetts Institute of Technology, Cambridge; J. C. Boyce, R. E. Bolz, G. B. Carson, W. L. Everitt, H. A. Foecke, M. D. Hooven, W. H. Miernyk, W. C. White.

DIVISION ACTIVITIES—GENERAL: Glenn Murphy, *Chairman*, Iowa State College, Ames; Committee members are chairmen and General Council Representatives of the following Divisions: Cooperative Engineering Education, Educational Methods, Evening Engineering Education, Graduate Studies, Relations with Industry, Technical Institute and Chairmen of the follow Committees: Ethics, Graduate Study Project, Technical Institute Curricula (*ad hoc*), YET Summer Institute (*ad hoc*) and Young Engineering Teachers.

DIVISION ACTIVITIES—INSTRUCTIONAL AND CURRICULA: C. A. Brown, *Chairman*, General Motors Institute, Flint, Mich.; Committee members are Chairmen and General Council Representatives of the following Divisions: Aeronautical, Agricultural, Architectural, Chemical, Civil, Electrical, Engineering Drawing, Engineering Economy, English, Humanistic-Social, Industrial, Mathematics, Mechanical, Mechanics, Mineral, Physics, and Chairmen of the following Committees: Engineering School Libraries, Nuclear Committee—Survey of Nuclear Manpower in Colleges and Universities, Survey of Teaching of English in Colleges of Engineering.

ENGINEERING RESEARCH CAPABILITIES OF THE UNITED STATES ENGINEERING COLLEGES: (See ECRC for committee personnel)

ENGINEERING SCHOOL LIBRARIES: I. A. Tumbleson, *Chairman*, Newark College of Engineering, Newark, N. J.; R. E. Betts, J. A. Bonell, M. Chamberlain, D. M. Crosland, Madeleine Gibson, A. R. Krull, Pearl G. Lewis, E. C. McClintock, Jr., J. H. Moriarity, Mary F. Pinches, Jeanette Poor, Samuel Sass.

ETHICS: W. W. Burton, *Chairman*, Minnesota Mining and Manufacturing Co., St. Paul, Minn.; F. T. Agthe, T. A. Boyle, C. Ebert, N. A. Christensen, J. D. Davis, R. A. Emerson, J. H. Foote, C. J. Freund, J. W. Graham, Jr., L. Helander, E. F. Obert, S. P. Olmsted, A. N. Paul, R. L. Peurifoy, L. E. Rich, W. F. Ryan, C. F. Savage, J. R. Snell, R. E. Swift, F. L. Cason.

EVALUATION REPORT FOLLOW-UP (*ad hoc*): Ernst Weber, *Chairman*, Polytechnic Institute of Brooklyn; C. S. Crouse, T. H. Evans, L. E. Grinter, H. L. Hazen, F. C. Lindvall, J. H. Rushton, B. R. Teare, Jr.

I. *Analysis and Design:* D. W. Ver Planck, *Chairman*, Carnegie Institute of Technology, Pittsburgh, Pa.; J. E. Arnold, E. E. Day, R. E. Fadum, M. S. Gjesdahl, D. L. Katz, D. H. Pletta, E. R. Schatz, Dana Young.

II. *Transfer and Rate Mechanisms:* R. R. White, *Chairman*, University of Michigan, Ann Arbor; L. N. Canjar, T. H. Evans, W. L. Everitt, R. G. Folsom, A. L. London, W. R. Marshall, J. H. Rushton, R. E. Treybal.

III. *Thermodynamics:* N. A. Hall, *Chairman*, Yale University, New Haven, Conn.; J. J. Martin, E. F. Obert, D. V. Ragone, F. D. Rossini, F. W. Sears, Myron Tribus.

IV. *Mechanics of Fluids:* V. L. Streeter, *Chairman*, University of Michigan, Ann Arbor; R. C. Binder, W. C. Nelson, H. Rouse, A. H. Shapiro, R. L. Sweigert, J. K. Vennard.

V. *Electrical Sciences:* T. L. Martin, *Chairman*, University of Arizona, Tucson; R. E. Beam, G. S. Brown, E. G. Smith, E. Weber, P. Weinberg.

VI. *Nature and Properties of Materials:* G. Murphy, *Chairman*, Iowa State College, Ames; R. M. King, B. J. Lazan, R. L. Sproull, T. E. Stelson, L. H. Van Vleck.

VII. *Mechanics of Solids:* P. F. Chenea, *Chairman*, Purdue University, Lafayette,

Ind.; J. P. Den Hartog, D. C. Drucker, N. J. Hoff, J. Ormondroyd, R. Schuhmann, Jr., J. O. Smith, D. Young.

FINANCIAL POLICY: M. M. Boring, *Chairman*, General Electric Co., Schenectady, N. Y.; W. L. Collins, John Gammell, W. C. White, E. R. Wilcox, W. R. Woolrich, T. Saville.

GEORGE WESTINGHOUSE AWARD: E. F. Obert, *Chairman*, Northwestern University, Evanston, Ill.; G. N. Cox, T. H. Evans, W. K. LeBold, E. J. Lindahl, G. A. Marston, R. S. Paffenbarger, R. W. Van Houten; G. D. Lobingier, *ex officio*.

GRADUATE STUDY PROJECT (*ad hoc*): R. G. Folsom, *Chairman*, University of Michigan, Ann Arbor; T. H. Chilton, N. A. Christensen, N. A. Hall, H. L. Hazen, E. E. Litkenhous, E. Weber.

Steering Committee: N. A. Hall, *Chairman*, Yale University, New Haven, Conn.; N. A. Christensen, R. G. Folsom, H. L. Hazen, E. E. Litkenhous.

HONORARY MEMBERSHIP: W. T. Alexander, *Chairman*, Northeastern University, Boston, Mass.; W. B. Boast, A. B. Bronwell, J. H. Davis, G. W. Farnham, J. A. Focht, A. T. Granger, L. E. Grinter, J. C. Reed, J. H. Rushton.

IDEAL REGISTRATION LAW (*ad hoc*): J. H. Sams, *Chairman*, Clemson College, Clemson, S. C.; G. F. Branigan, A. S. Janssen, K. F. Wendt.

INDUSTRIAL FELLOWSHIP: K. B. McEachron, Jr., *Chairman*, Case Institute of Technology, Cleveland, Ohio; G. F. Branigan, J. R. Cudworth, P. E. Hemke, S. S. Kistler, W. A. Lewis, Jr., R. A. Morgen, M. H. Trytten, H. E. Wessman.

INDUSTRIAL MEMBERSHIP: W. D. McIlvaine, Jr., *Chairman*, University of Michigan, Ann Arbor; F. E. Allen, B. C. Baker, Merl Baker, F. H. Berleth, B. B. Bright, W. L. Collins, H. W. Gouldthorpe, J. H. Howard, W. G. Ireson, G. D. Lobingier, C. W. Muhlenbruch, A. D. Preston, D. L. Pyke, John Avery, C. E. Schaffner, A. L. Townsend, W. R. Weems, E. L. Yates.

INTERNATIONAL RELATIONS: (See ECAC for committee personnel).

JAMES H. MCGRAW TECHNICAL INSTITUTE AWARD: L. V. Johnson (1958), *Chairman*, Southern Technical Institute, Chamblee, Ga.; C. L. Foster (1958), C. S. Jones (1960), R. W. Marsh (1960), D. C. Metz (1959), K. R. Miller (1959), E. W. Smith (1958), K. L. Holderman, *ex officio*.

JUDGING OF THE YET PAPER CONTEST: Peter Balise, *Chairman*, University of Washington, Seattle; Margaret D. Blickle, W. H. Crater.

LAMME AWARD: J. H. Sams, *Chairman*, Clemson College, Clemson, S. C.; R. S. Burington, J. C. Calhoun, Jr., R. L. Sweigert, C. L. Eckel, R. E. Fadum, E. D. Howe, W. P. Kimball, J. C. McKeon, J. T. Rettaliata, N. F. Rode.

LOSS OF FACULTY TO INDUSTRY: A. R. Hellwarth, *Chairman*, Detroit Edison Co., Detroit, Mich.; L. R. Baker, M. M. Boring, D. S. Bridgman, E. I. Feisenheiser, L. H. Lamouria.

MANPOWER: (See ECAC for committee personnel).

MILITARY AFFAIRS: (See ECAC for committee personnel).

NATIONAL LEGISLATION: H. K. Work, *Chairman*, New York University, New York, N. Y.; M. M. Boring, W. T. Cavanaugh, H. A. Meyeroff, P. H. Robbins.

NOMINATING COMMITTEE: N. W. Dougherty, *Chairman*, University of Tennessee, Knoxville, H. H. Armsby, M. M. Boring, R. M. Campbell, N. A. Christensen, V. L. Doughtie, A. B. Drought, W. L. Everitt, C. O. Frush, F. A. Heacock, E. K. Kraybill, A. Lesser, Jr., B. T. McMinn, B. H. Norem, R. G. Owens, R. L. Peurifoy, J. H. Pitman, L. A. Richardson, W. M. Richtmann, June Roberts, R. D. Sloan, H. M. Hess.

NOMINATING—ECAC: (See ECAC for Committee personnel).

NOMINATING—ECRC: (See ECRC for committee personnel).

NUCLEAR: R. W. Moulton, *Chairman*, University of Washington, Seattle; H. R. Beatty, C. K. Beck, C. F. Bonilla, L. B. Borst, P. F. Chenea, W. H. Crew, C. E. Dryden, H. J. Gomberg, W. W. Grigorieff, Norman Hilberry, H. S. Isbin, G. D. Lobingier, R. J. Martin, L. V. McLean, Glenn Murphy, R. A. Patterson, P. N. Powers, D. S. Roberts, M. W. White.

1. *Survey of Nuclear Manpower in Colleges and Universities:* L. V. McLean, *Project Director*, Louisiana State University, Baton Rouge.

PLANNING: S. C. Hollister, *Chairman*, Cornell University, Ithaca, N. Y.; A. B. Bronwell, L. E. Grinter, B. R. Teare, Jr., E. A. Walker.

PROGRAM—ECRC: (See ECRC for committee personnel).

PUBLICATIONS: W. Leighton Collins, *Chairman*, University of Illinois, Urbana; Renato Contini, W. L. Everitt, G. W. Farnham, W. C. Laity, E. C. McClintock, Jr., M. E. Van Valkenberg, H. E. Wessman.

PUBLICATIONS—ECRC: (See ECRC for committee personnel).

PUBLIC RELATIONS: J. I. Mattill, *Chairman*, Massachusetts Institute of Technology, Cambridge; Irwin Blumenfeld, J. H. Bolton, H. G. Botset, G. U. Cleeton, C. M. Hall, J. W. Kelly, E. C. McClintock, Jr., G. C. Pearl, R. W. Schmelzer, D. R. Wilkes.

RELATIONS WITH FEDERAL GOVERNMENT: (See ECRC for committee personnel).

RELATIONS WITH INDUSTRIAL RESEARCH AGENCIES: (See ECRC for committee personnel).

RESEARCH ADMINISTRATION: (See ECRC for committee personnel).

SECONDARY SCHOOLS: (See ECAC for committee personnel).

SECTIONS AND BRANCHES—EASTERN: R. W. Van Houten, *Chairman*, Newark College of Engineering, Newark, N. J.; Committee Members: Chairmen and General Council Representatives of the following Sections: Allegheny, Illinois-Indiana, Michigan, Middle Atlantic, National Capital Area, New England, Ohio, Southeastern, Upper New York-Ontario; and Charimen of the following Branches: University of Alabama, Clarkson College, University of Detroit, University of Florida, University of Illinois, Navy Pier, Chicago, Illinois, University of Maine, North Carolina State College, Northeastern University, Purdue University, University of Tennessee.

SECTIONS AND BRANCHES—WESTERN: C. L. Eckel, *Chairman*, University of Colorado, Boulder; Committee Members: Chairmen and General Council Representatives of the following Sections: Kansas-Nebraska, Missouri-Arkansas, North Midwest, Pacific Northwest, Pacific Southwest, Rocky Mountain, Southwestern; and Chairmen of the following Branches: Colorado State University, Colorado School of Mines, University of Colorado, Michigan College of Mining & Technology, University of Minnesota, Texas A. & M. College, State College of Washington, University of Washington.

SELECTION AND GUIDANCE: (See ECAC for committee personnel).

SURVEY OF TEACHING OF ENGLISH IN COLLEGES OF ENGINEERING (*ad hoc*): C. A. Brown, *Chairman*, General Motors Institute, Flint, Mich.; M. M. Boring, G. B. Carson, G. J. Christensen, H. O. Croft, Thomas Farrell, Jr., Paul Fatout, C. B. Hill, J. C. McKeon, P. E. Mohn, J. H. Pitman, D. G. Stillman, R. L. Sweigert, R. W. Van Houten, J. L. Vaughan, W. R. Woolrich, E. L. Yates.

TECHNICAL INSTITUTE CURRICULA (*ad hoc*): D. E. Irwin, *Chairman*, General Electric Company, Schenectady, N. Y.; Committee Members: Technical Institute Division: G. R. Henninger, G. R. Maedel, A. R. Sims; and Relations with Industry Division: F. H. Berleth, R. A. Emerson, H. E. Heath, S. M. Little, Walter Whipple.

NATIONAL SURVEY OF TECHNICAL INSTITUTE EDUCATION: K. L. Holderman, *Chairman*, Pennsylvania State University, University Park; G. R. Henninger, *Survey Director*, Iowa State College, Ames; H. R. Beatty, C. J. Freund, G. A. Gullette, R. L. Shurter, L. F. Smith, M. M. Boring.

TEXTILE ENGINEERING: M. J. Lydon, *Chairman*, Lowell Technological Institute, Lowell, Mass.; C. L. Adams, H. A. Dickert, C. F. Edlund, R. K. Flege, W. J. Hamberger, M. E. Heard, G. E. Hopkins, E. P. Stevenson.

TO STUDY ACCREDITATION BY INDIVIDUAL STATES (*ad hoc*): (See ECAC for committee personnel).

VINCENT BENDIX AWARD: (See ECRC for committee personnel).

YET SUMMER INSTITUTE (*ad hoc*): E. K. Kraybill, *Chairman*, Duke University Durham, N. Car.; W. T. Alexander, T. A. Boyle, Jr., N. A. Christensen, H. A. Foecke, F. L. Goetzenberger, R. L. Harrington, A. R. Hellwarth, G. E. Moore, A. R. Spalding.

YOUNG ENGINEERING TEACHERS: H. A. Foecke, *Chairman*, Notre Dame University, Notre Dame, Ind.; D. R. Lamb, C. J. Sperry, Jr., J. G. Richter, R. D. LaRue, G. D. Moon, T. H. Rockwell.

OFFICERS OF DIVISIONS, 1957-1958

AERONAUTICAL:
Chairman: V. S. Haneman, Air Force Institute of Technology, Wright-Patterson AFB, Ohio
Vice Chairman: E. W. Anderson, Iowa State College, Ames, Iowa
Secretary: G. C. Clementson, USAF Academy, Lowry AFB, Denver, Colo.
Representative: L. Z. Seltzer, West Virginia University, Morgantown, W. Va.
Editor: D. W. Dutton, Georgia Institute of Technology, Atlanta, Ga.
Program Chm.: K. H. Roper, Air Force Institute of Technology, Wright-Patterson AFB, Ohio
Exec. Comm.: V. S. Haneman, Jr., H. W. Barlow, J. J. Cleary, G. C. Clementson, B. C. Boulton, J. W. Hoover, E. W. Anderson, D. W. Dutton

AGRICULTURAL:
Chairman: June Roberts, Washington State College, Pullman, Wash.
Vice Chairman: G. E. Spencer, Purdue University, Lafayette, Ind.
Secretary: J. L. Butt, ASAE Headquarters, St. Joseph, Mich.
Representative: June Roberts, Washington State College, Pullman, Wash.
Exec. Comm.: C. G. E. Downing, F. A. Kummer, F. E. Peikert
Program Chmn.: J. Roberts, Washington State College, Pullman, Wash.

ARCHITECTURAL:
Chairman: A. J. McGaw, University of Wyoming, Laramie, Wyo.
Vice Chairman: R. E. Means, Oklahoma State University, Stillwater, Okla.
Secretary: M. W. Isenberg, Pennsylvania State University, University Park, Pa.
Representative: L. A. Richardson, Pennsylvania State University, University Park, Pa.

CHEMICAL:
Chairman: Lloyd Berg, Montana State College, Bozeman, Mont.
Vice Chairman: M. H. Chetrick, University of Louisville Institute of Industrial Research, Louisville, Ky.
Secretary: H. P. Munger, Syracuse University, Syracuse, N. Y.
Representative: J. O. Hougen, Monsanto Chemical Company, St. Louis, Mo.
Editor: A. H. Cooper, Pratt Institute, Brooklyn, N. Y.
Exec. Comm.: Morton Smutz, G. H. Beyer, Lloyd Berg, J. O. Hougen
Program Chmn.: Lloyd Berg, Montana State College, Bozeman, Mont.

CIVIL:
Chairman: B. A. Whisler, The Pennsylvania State University, University Park, Pa.
Vice Chairman: R. C. Brinker, The Ronald Press Company, New York, N. Y.
Secretary: L. K. Downing, Howard University, Washington, D. C.
Representative: R. L. Peurifoy, A. & M. College of Texas, College Station, Tex.
Editor: C. J. Smith, The Pennsylvania State University, University Park, Pa.
Exec. Comm.: D. F. Peterson, Jr., R. K. Linsley, R. E. Stiemke, C. K. Wang
Program Chmn.: Russ Brinker, The Ronald Press Co., 15 East 26th St. New York 10, N. Y.

COOPERATIVE ENGINEERING EDUCATION:
Chairman: R. L. Wooldridge, Northeastern University, Boston, Mass.
Vice Chairman: J. L. Cain, Virginia Polytechnic Institute, Blacksburg, Va.
Secretary: A. W. Angrist, Ford Motor Company, Dearborn, Mich.
Representative: E. K. Hamlen, University of Akron, Akron, Ohio
Exec. Comm.: R. L. Wooldridge, J. L. Cain, A. W. Angrist, E. K. Hamlen
Program Chmn.: J. L. Cain, Coordinator, Virginia Polytechnic Institute, Blacksburg, Va.

EDUCATIONAL METHODS:
Chairman: Philip Nudd, The Cooper Union, Cooper Square, N. Y.
Vice Chairman: C. E. Schaffner, Polytechnic Institute of Brooklyn, Brooklyn, N. Y.
Secretary: H. W. Case, University of California, Los Angeles, Cal.
Representative: E. K. Kraybill, Duke University, Durham, N. C.
Exec. Comm.: H. I. Tarpley, E. B. Stavely, W. K. LeBold
Program Chmn.: C. E. Schaffner, Associate Dean, Polytechnic Institute of Brooklyn, Brooklyn 1, N. Y.

ELECTRICAL ENGINEERING:
Chairman: J. S. Johnson, Wayne State University, Detroit, Mich.

Vice Chairman: A. V. Eastman, University of Washington, Seattle, Wash.
Secretary: J. H. Mulligan, Jr., New York University, New York, N. Y.
Representative: Samuel Seely, Case Institute of Technology, Cleveland, Ohio
Exec. Comm.: J. S. Johnson, A. V. Eastman, J. H. Mulligan, Jr., Samuel Seely
Program Chmn.: J. Stuart Johnson, Wayne State University, Detroit 2, Mich.

ENGINEERING DRAWING:
Chairman: W. J. Luzadder, Purdue University, West Lafayette, Ind.
Vice Chairman: J. S. Rising, Iowa State College, Ames, Iowa
Secretary: J. S. Blackman, University of Nebraska, Lincoln, Neb.
Representative: F. A. Heacock, Princeton University, Princeton, N. J.
Editor: "Journal of Engineering Drawing" —Irwin Wladaver, New York University, New York, N. Y.
"Graphic Science Section—ASEE Journal"—E. G. Pare, Illinois Institute of Technology, Chicago, Ill.
Exec. Comm.: W. J. Luzadder, J. S. Rising, F. A. Heacock, E. G. Pare, J. S. Blackman, I. L. Hill, J. H. Porsch, C. J. Vierck, C. H. Springer, A. P. McDonald, I. Wladaver, B. L. Wellman, M. McNeary, E. M. Griswold
Program Chmn.: W. J. Luzadder, Purdue University, West Lafayette, Ind.

ENGINEERING ECONOMY:
Chairman: A. R. Gruehr, Polytechnic Institute of Brooklyn, Brooklyn, N. Y.
Vice Chairman: F. A. Gitzendanner, Standard Oil Company of Indiana, Whiting, Ind.
Secretary: N. A. Barish, New York University, Bronx, N. Y.
Representative and Editor: Arthur Lesser, Jr., Stevens Institute of Technology, Hoboken, N. J.
Exec. Comm.: A. R. Gruehr, F. A. Gitzendanner, N. A. Barish, Arthur Lesser, Jr.
Program Chmn.: F. A. Gitzendanner, Standard Oil Co. of Ind., Whiting, Ind.

ENGLISH:
Chairman: W. C. Laity, Montana School of Mines, Butte, Mont.
Vice Chairman: J. S. Cook, Pennsylvania State University, University Park, Pa.
Secretary: S. R. Watson, Fenn College, Cleveland, Ohio
Representative: J. H. Pitman, Newark College of Engineering, Newark, N. J.
Editor: C. K. Arnold, Pennsylvania State University, University Park, Pa.
Exec. Comm.: W. C. Laity, J. S. Cook, Paul Fatout, H. M. Chapman, D. G. Stillman, S. R. Warren, P. E. Mohn, C. A. Brown, W. P. Jones, J. P. Rappalo, G. J. Christensen, Watson Thompson
Program Chmn.: J. W. Sauther, University of Washington, Seattle 5, Wash.

EVENING ENGINEERING EDUCATION:
Chairman: E. A. Gramstorff, Northeastern University, Boston, Mass.
Vice Chairman: E. A. Salma, New York University, New York, N. Y.
Secretary: S. B. Ingram, Bell Telephone Laboratories, Inc., New York, N. Y.
Representative: K. W. Riddle, Drexel Institute of Technology, Philadelphia, Pa.
Exec. Comm.: E. A. Gramstorff, E. A. Salma, S. B. Ingram, K. W. Riddle
Program Chmn.: E. A. Salma, New York University, University Heights, Bronx, N. Y.

GRADUATE STUDIES:
Chairman: P. F. Chenea, Purdue University, Lafayette, Ind.
Vice Chairman: A. L. Jorissen, Cornell University, Ithaca, N. Y.
Secretary: W. C. Stoker, Rensselaer Polytechnic Institute, East Windsor Hill, Conn.
Representative: N. A. Christensen, Cornell University, Ithaca, N. Y.
Exec. Comm.: D. H. Pletta, G. D. McCann, J. L. Merian, J. A. Sauer, E. M. Williams

HUMANISTIC-SOCIAL:
Chairman: Melvin Kranzberg, Case Institute of Technology, Cleveland, Ohio
Vice Chairman: A. A. Lawrence, U. S. Coast Guard Academy, New London, Conn.
Secretary: W. H. Davenport, Harvey Mudd College, Claremont, Cal.
Representative: S. P. Olmsted, Rensselaer Polytechnic Institute, Troy, N. Y.
Editor: W. H. Davenport, Harvey Mudd College, Claremont, Cal.
Exec. Comm.: H. M. Chapman, G. A. Gullette, R. S. Childs, C. W. Condit, A. D. Chandler, Jr., D. G. Stillman, P. E. Mohn, Thomas Farrell, Jr., W. K. Brown, Edward Lurie, A. A. Hobgood
Program Chmn.: Capt. A. A. Lawrence, U. S. Coast Guard Academy New London, Connecticut

INDUSTRIAL:
Chairman: A. F. Gould, Lehigh University, Bethlehem, Pa.
Vice Chairman: Gerald Nadler, Washington University at St. Louis, St. Louis, Mo.
Secretary: R. G. Carson, Jr., North Carolina State College, Raleigh, N. C.
Representative: B. H. Norem, Syracuse University, Syracuse, N. Y.
Exec. Comm.: A. F. Gould, Gerald Nadler, R. G. Carson, B. H. Norem
Program Chmn.: Arthur Gould, Lehigh University, Bethlehem, Pa.

MATHEMATICS:
Chairman: C. R. Wylie, University of Utah, Salt Lake City, Utah
Vice Chairman: H. A. Giddings, New York University, New York, N. Y.
Secretary: W. E. Restemeyer, University of Cincinnati, Cincinnati, Ohio
Representative: Haim Reingold, Illinois Institute of Technology, Chicago, Ill.
Exec. Comm.: C. O. Oakley, G. B. Thomas, W. G. Warnock
Program Chmn.: Clarence Wylie, University of Utah, Salt Lake City, Utah

MECHANICAL ENGINEERING:
Chairman: N. A. Hall, Yale University, New Haven, Conn.
Vice Chairman: D. L. Perkins, Wayne State University, Detroit, Mich.
Secretary: V. L. Doughtie, University of Texas, Austin, Tex.
Representative: B. T. McMinn, University of Washington, Seattle, Wash.
Editors: C. O. Anderson, North Dakota Agricultural College, Fargo, N. D., F. E. Rossen, New York University
Exec. Comm.: N. A. Hall, D. L. Perkins, V. L. Doughtie, H. J. Stoever, Joseph Modrey, J. F. Lee
Program Chmn.: Newman A. Hall, Yale University, New Haven, Conn.
Heat & Power Subdivision:
Chmn.: H. J. Stoever, Iowa State College, Ames, Iowa
V. Chmn.: A. B. Cambel, Northwestern University, Evanston, Ill.
Secretary: V. M. Faires, North Carolina State College, Raleigh, N. C.
Editor: C. O. Anderson, North Dakota Agricultural College, Fargo, N. D.
Machine Design and Manufacturing Processes Subdivision:
Chmn.: Joseph Modrey, Union College, Schenectady, N. Y.
V. Chmn.: E. E. Day, University of Washington, Seattle, Wash.
Secretary: A. S. Hall, Purdue University, Lafayette, Ind.
Editor: F. E. Posser, Mechanical Engineering Department, New York University, N. Y.

MECHANICS:
Chairman: D. F. Gunder, 463 W. Fifth Street, Loveland, Colo.
Secretary: V. S. Haneman, Jr., Air Force Institute of Technology, Wright-Patterson AFB, Ohio
Representative: F. L. Singer, New York University, New York, N. Y.
Editor: A. W. Davis, Iowa State College, Ames, Iowa
Exec. Comm.: H. F. Marco, P. F. Chenea, R. L. Flanders, Archie Higdon, L. A. Smith, J. O. Smith
Program Chmn.: D. R. Carver, Louisiana State University, Baton Rouge, La.

MINERAL ENGINEERING:
Chairman: D. S. Eppelsheimer, Missouri School of Mines, Rolla, Mo.
Vice Chairman: W. W. Kriegel, 149 Dallan Road, Newark, Del.
Secretary: J. P. Spielman, Washington State College, Pullman, Wash.
Representative: C. O. Frush, Colorado School of Mines, Golden, Colo.
Exec. Comm.: C. O. Frush, W. W. Kriegel
Program Chmn.: W. W. Kriegel, 149 Dallam Road, Newark, Delaware

PHYSICS:
Chairman: M. W. White, The Pennsylvania State University, University Park, Pa.
Vice Chairman: L. P. Smith, Avco Manufacturing Corporation, Lawrence, Mass.
Secretary: J. G. Potter, A. & M. College of Texas, College Station, Tex.
Representative: R. J. Seeger, National Science Foundation, Washington, D. C.
Editor: C. E. Bennett, University of Maine, Orono, Me.
Exec. Comm.: J. H. Howey, G. H. Carragan, A. J. M. Johnson, L. O. Olsen
Program Chmn.: Marsh White, Pennsylvania State University, University Park, Pa.

RELATIONS WITH INDUSTRY:
Chairman: R. A. Emerson, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Vice Chairman: H. R. Bintzer, Carnegie Institute of Technology, Pittsburgh, Pa.
Secretary: G. K. Dreher, Steel Founders' Society of America, Cleveland, Ohio
Publicity Comm. Chmn.: C. H. Ebert, Jr., Westinghouse Electric Corporation, East Pittsburgh, Pa.
Representative: J. F. Downie Smith, Iowa State College, Ames, Iowa
Bd. of Directors: C. H. Ebert, Jr., John Gammell, D. E. Irwin, F. H. Berleth, J. M. English, S. M. Little, Cornelius Wandmacher, E. E. Bartleson
Program Chmn.: E. E. Bartleson, American Telephone and Telegraph Co., 195 Broadway, New York, N. Y.

TECHNICAL INSTITUTE:
Chairman: K. L. Holderman, The Pennsylvania State University, University Park, Pa.
Vice Chairman: A. R. Simms, University of Houston, Houston, Tex.
Secretary: L. V. Johnson, Southern Technical Institute, Chamblee, Ga.
Treasurer: D. C. Metz, University of Dayton, Dayton, Ohio
Representative: K. O. Werwath, Milwaukee School of Engineering, Milwaukee, Wis.
Editor: J. I. Miller, McGraw-Hill Book Company, New York, N. Y.
Exec. Comm.: K. O. Werwath, K. L. Holderman, D. C. Metz, C. S. Jones, J. I. Miller, H. P. Adams, V. R. Daugherty, G. R. Henninger, L. V. Johnson, C. S. Jones, E. H. Rietzke, L. F. Smith, H. W. Hartley, H. W. Shaw, A. R. Sims, H. R. Beatty, K. L. Burroughs, R. W. Marsh, W. K. Mayo, K. R. Miller, L. G. Morey, E. W. Smith

OFFICERS OF SECTIONS, 1957-1958

ALLEGHENY:
Chairman: R. D. Slonneger, West Virginia University
Vice Chairman: J. R. Smith, University of Pittsburgh
Secretary: M. J. Smith, West Virginia University
Council Repr.: Walton Forstall, Carnegie Institute of Technology (1959)
YET Repr.: Kenneth Hunter, Pennsylvania State University

ILLINOIS-INDIANA:
Chairman: F. W. Trezise, University of Illinois, Navy Pier
Vice Chairman: R. E. Gibbs, Bradley University
Secretary: H. L. Wakeland, University of Illinois
Council Repr.: R. G. Owens, Illinois Institute of Technology (1958)
YET Repr.: A. P. Boresi, University of Illinois
Exec. Comm.: L. J. Fletcher, Jr., W. F. Stevens, R. O. Loving, W. L. Hull, E. W. Jerger, N. E. Baughman, J. H. Porsch

KANSAS-NEBRASKA:
(New officers to be elected in October, 1957)
President: K. Razak, University of Wichita
Vice Pres. W. P. Smith, University of Kansas
Vice Pres.: M. E. Raville, Kansas State College
Secretary: E. B. Meier, University of Nebraska
YET Repr.: D. O. Pierce, University of Nebraska
Council Repr.: N. H. Barnard, University of Nebraska (1957)

MICHIGAN:
Chairman: G. B. Uicker, University of Detroit
Vice Chairman: M. M. Ryan, Lawrence Institute of Technology
Secretary: Richard Schneidewind, University of Michigan
Council Repr.: H. M. Hess, Wayne State University
YET Repr.: W. F. Edington, General Motors Institute

MIDDLE ATLANTIC:
(New officers to be elected in December 1957)
Chairman: W. G. McLean, Lafayette College
Vice Chairman: B. W. Bartlett, U. S. Military Academy, West Point
Secretary: J. B. Baker, Drexel Institute of Technology

Council Repr.: E. C. Easton, Rutgers University
YET Repr.: J. H. Weinstein, Newark College of Engineering
RWI Liaison: F. W. Slantz, Lafayette College

MISSOURI-ARKANSAS:
Chairman: L. B. Gulbransen, Washington University
Vice Chairman: G. H. Beyer, University of Missouri
Secretary: John Zaborsky, Washington University
Council Repr.: V. J. Blum, Saint Louis University
Physics Liaison: W. A. Barker, Saint Louis University
YET Repr.: O. W. Miller, Washington University

NATIONAL CAPITAL AREA:
Chairman: D. W. Marlowe, Catholic University of America
Vice Chairman: K. C. Harder, Office of Naval Research
Secretary: Albert Preisman, Capitol Radio Engineering Institute
Council Repr.: H. H. Armsby, U. S. Office of Education
YET Repr.: G. E. McDuffie, Catholic University of America

NEW ENGLAND:
(New officers to be elected in October, 1957)
Chairman: W. S. Evans, University of Maine
Secretary: J. S. Marcus, University of Massachusetts
Council Repr.: E. F. Littleton, Tufts University
YET Repr.: A. E. Bryson, Harvard University
RWI Repr.: L. B. Landall, Raytheon Manufacturing Co.
Physica Liaison: C. E. Bennett, University of Maine

NORTH MIDWEST:
(New officers to be elected in October, 1957)
Chairman: P. A. Cartwright, University of Minnesota
Vice Chairman: T. J. Higgins, University of Wisconsin
Secretary: T. E. Murphy, University of Minnesota
Council Repr.: A. B. Drought, Marquette University
Exec. Comm.: D. F. Young, J. D. Horgan, H. B. Anderson, R. N. Faiman, K. E. Lindley, J. O. Osburn, C. J. Thomforde
RWI liaison: W. A. Longacre, Michigan College of Mining & Tech.
Physics liaison: W. R. Hudson, University of Iowa
Division Chairman: Chemical Engr. H. S. Isbin, University of Minnesota, Civil Engr. L. G. Straub, University of Minnesota, Mechanical Engr. O. A. Leo, University of Minnesota; Mechanics F. E. Miller, University of Minnesota

OHIO SECTION:
Chairman: M. L. Smith, Ohio State University
Vice Chairman: N. D. Thomas, Ohio University
Vice Chairman: Maurice Graney, University of Dayton
Secretary: R. C. Quisenberry, Ohio University
Council Repr.:
Editor: M. D. Blickle, Ohio State University
YET Repr.: R. I. Hang, Ohio State University
RWI liaison: J. H. Toulouse, Owens-Illinois Glass Co.
Physics liaison: J. J. Turin, University of Toledo
Chairman Continuity Committee: G. E. Pankratz, University of Toledo
Exec. Comm.: M. L. Smith, N. D. Thomas, Maurice Graney, R. C. Quisenberry, M. D. Blickle

PACIFIC NORTHWEST:
Chairman: A. D. Hughes, Oregon State College
Vice Chairman: J. B. Rodgers, Oregon State College
Secretary: P. C. Magnusson, Oregon State College
Council Repr.: R. D. Sloan, State College of Washington
YET Repr.: B. E. Smith, Oregon State College

PACIFIC SOUTHWEST:
Chairman: I. J. Sandorf, University of Nevada
Vice Chairman: Bonham Campbell, University of California, Los Angeles
Secretary: Martin Capp, San Diego State College
Council Repr.: D. E. Whelan, Jr., Loyola University of Los Angeles

(*Continued on page 152*)

MINUTES OF THE EXECUTIVE BOARD MEETINGS

Cornell University, Ithaca, New York

June 16 and 19, 1957

Because the April 26 and 27 meetings of the Executive Board at Toledo, Ohio, came too late for inclusion of reports in the June issue, detailed minutes are not being published at this time. Mimeographed copies, 17 pages in length, are available on request from the Secretary, and can be published in full if interest justifies.

A dinner meeting of the Executive Board of the American Society for Engineering Education was held in the Shadow Box Room of Statler Hall, Cornell University, on June 16 and continued at a dinner meeting in the Chinese Room of Statler Hall on June 19, 1957. Those present on both dates were W. L. Everitt, President; W. T. Alexander, C. A. Brown, F. C. Lindvall, and R. J. Woodrow, Vice Presidents; John Gammell, Treasurer; W. Leighton Collins, Secretary, and E. C. McClintock, Jr., as Editor of the JOURNAL. The newly elected vice presidents, C. L. Eckel, Glenn Murphy, and R. W. Van Houten, were present on the 19th. President W. L. Everitt presided.

In order to avoid unnecessary duplication of information, President Everitt requested each officer to report only on those aspects of their Annual Reports coming within the jurisdiction of the Executive Board. The complete reports of officers are appendices to the minutes of the meeting of the General Council, June 17 and 21, 1957 and are to be published separately.

Correction to Minutes of the meeting of the Executive Board of April 26, 1957. The Executive Board *VOTED* to approve the minutes of its April 26, 1957 meeting with Item 10 i. reading ". . . reviewed ECRC's decision . . ." instead of ". . . reviewed EJC's decision. . . ."

1. *Report of the Secretary,* W. Leighton Collins.

a. *Individual memberships.* About 850 have been added during the year, 450 since the *Yearbook* data were compiled. About four per cent are delinquent in dues payment for the year, a figure which is comparable to the findings of other engineering societies. Future increases in the total amount of individual dues collected will occur only with an increase in membership.

b. *Institutional memberships.* There has been a steady increase, primarily due to the efforts of W. D. McIlvaine, Jr. of the University of Michigan. He has agreed to serve as chairman of the committee for next year.

c. *Personnel needs.* A full-time secretary is needed to replace the part-time student help. The Editorial Secretary should be relieved of the routine *Yearbook* work in order to do more actual editorial work and to have more time available to increase the amount of advertising; Mrs. Naomi Garman also needs to be relieved of certain routine matters in order to be of more help to the Secretary.

d. *Secretary's travel.* Although 23 meetings were attended during the year, many were of a simultaneous nature or combined into a smaller number of trips. EJC and ECPD board meetings were not attended except as they coincided with annual meetings. Since society secretaries are involved in many EJC committee activities the Secretary has not participated effectively.

e. *Insurance.* In accordance with the action recommended at the April 26, 1957 meeting of the Executive Board, the Society is now protected by liability insurance ($100,000–$300,000), workmen's compensation, and a non-ownership automobile insurance policy. The Society is thus protected against claims resulting from accidents at all of its meetings and normal activities, and from driving on Society business.

f. *Revision of the Constitution.* Only 92 ballots were cast in approving the changes in the Constitution. This indicates lethargy on the part of the membership, non-controversial changes, or a poor balloting procedure. It was agreed that voting of the membership is important and that the mailing of a separate ballot is preferable to the use of a tear-out sheet in the Journal of Engineering Education.

g. *Public relations.* A gradual decrease in the number of complaints and increased cooperation within the various units of the Society is interpreted as an improvement in public relations. The general policy has been to answer all letters received. There also has been an increase in the number of clip sheets received from other organizations, indicating an improved coverage of ASEE activities.

h. *YET paper contest.* The rules for judging prepared and distributed last year seemed to have worked very well. The number of Sections participating did not increase but the general quality improved over last year.

i. *Use of membership lists.* The number of requests received for permission to use the *Yearbook* for the preparation of mailing lists to advertise products has been increasing rapidly. It was agreed that the present policy of *not* selling the membership list for the preparation of mailing lists for the purpose of advertising should be continued, and that the present practice of having a note to that effect in the *Yearbook* should be continued. This policy is in agreement with the general practices of most other EJC societies. Making the list available, as in the past, for limited use for the benefit of the membership may be granted by the Secretary on behalf of the Executive Board.

2. *Report of the Treasurer,* John Gammell

a. *Pro-forma statement.* The prepared statement, Appendix "A", indicates a favorable balance for the year of about $11,000. This is not entirely correct because of the receipts and expenditures pertaining to the summer institutes. About $2000 of the $4050 received is included in the expenditures because a separation could not be made until AEC had made a definite commitment; the remainder of the fund will be spent in the next fiscal year. Thus the actual favorable balance is about $9000. Because of this favorable balance the Executive Board *VOTED* to pay the $1000 for the Study of the Engineering Profession out of this year's funds, the

amount to come from the unallocated surplus. Thus the final favorable balance is about $8000.

b. *Budget for 1957–58.* The income, Appendix "A", is based on a continued growth of the Society. That is the only way a balanced budget could be prepared without increasing the dues of individual members. The growth planned is reasonable, a *net* increase of 350 individual members, a *net* increase of 10 industrial members, and an increase in advertising income of about $3000.

The proposed expenditures were discussed and some modifications made. The Executive Board *VOTED* approval of the renting of a postage meter, the rental to be included in the budget.

The Executive Board *VOTED* approval of the modified budget, Appendix "A", for the fiscal year 1957–58.

c. *Reserve for emergencies.* As a result of the favorable balance for 1956–57 and the balanced budget for 1957–58, the Executive Board *VOTED* to transfer up to $10,000 of unappropriated surplus to the Emergency Reserve. This action brings that fund up to a maximum of $60,000, which is still $15,000 less than the amount required by the recommendation of the Financial Policy Committee.

3. *Reports of Vice Presidents*

a. *ECAC,* W. T. Alexander. No report.

b. *ECRC,* R. J. Woodrow. Concern is expressed over EJC's report on "Practice of Engineering" because it might interfere with research contracts in educational institutions. The Executive Committee of ECRC wishes to consider the proposal and present a report at a later time.

c. *Sections and Branches,* F. C. Lindvall. A study of the reports of Sections indicated that about 2500 persons participated. They may or may not have been members of the Society. There is little family participation and there seems to be no relation between Section area and attendance. A large attendance in large cities does not necessarily materialize, most probably due to the many other activities in which members are engaged.

The Manual for Section Officers has been reviewed and should be revised. Needed changes are not extensive and can be handled by correspondence between the Secretary and appropriate vice presidents.

The compilation of information obtained by H. A. Foecke on the YET Paper Contest and on Branches should be considered for publication in the *Journal* or, at least, notes about their availability should be published.

d. *Divisions and Committees,* C. A. Brown. A possible problem of the future is the studying of Division activities to be certain they remain within the scope of what Divisions should be doing and not something which should be a Society activity. The discussion emphasized that any project for which funds are solicited becomes a Society project because the money must be raised by the Society and in the name of the Society. The study itself, however, may be carried out by a Division. It also was agreed that any activity involving the influencing of legislation needed to be considered a Society activity because of its bearing on the tax exemption status of the Society.

The Executive Board agreed that subject matter Divisions should be encouraged to sponsor joint sessions with appropriate professional societies

(such as the Civil Engineering Division with the American Society of Civil Engineers) at their annual meetings. This would result in added purpose for the existence of Divisions, enable them to have a broader influence, and establish closer relationships with practicing engineers.

4. *Report of the Editor,* E. C. McClintock, Jr. The listing of the JOURNAL in "Standard Rates and Data" is under way. Plans for a direct mail approach to increase the amount of advertising are being developed; one category will be the present institutional members and another will be non-members who should be advertising in the JOURNAL because of their products and relations with engineers. A "Manual for Authors" has been prepared, which includes instructions for preparation of copy, photographs, etc. A meeting with Division Editors is planned in order to develop cooperation in all aspects of Society publications. Negotiations with Lancaster Press to reduce production time are continuing; it was agreed a relatively firm stand should be taken on the right to submit a portion of the content of each issue at such date that reasonably current material can be included in each issue.

5. *1957–58 Membership Campaign*

a. *Individual.* The Secretary reported that last year's YET activities on membership were organized in about 30 per cent of the member institutions. No data are available to measure the effectiveness of the effort at any given school. It was agreed that the YET's be requested to continue their efforts, but that after a reasonable time for organization the deans be asked to assist in organizing a local group to expand membership.

b. *Associate institutional.* It was agreed that the number of members was exceedingly small relative to the potential, and that all possible means of expansion should be explored and activated.

6. *Reports of Committees*

a. *Public Relations,* John Mattill, Chairman. The report had been distributed previously. The discussion resulted in several general conclusions:

1. If more publicity is desirable it must be decided for what it is wanted and who is to be impressed. Objectives or aims are requirements of a constructive program. After establishment of objectives must come a step-by-step procedure for achieving them.

2. The underselling of the teaching profession by those engaged in it should be stopped. Students are told the advantages of being in industry, but are not adequately informed of the advantages of the teaching profession.

3. The JOURNAL should not be developed into a news sheet. It should contain a certain amount of current information, but Society subject matter and all aspects of engineering education are vital contents. This means selling engineering education—the Society and its work—in order that ASEE be identified with other educational societies in engineering and science and that the impact of ASEE in matters of engineering education be greater than the impact of professional engineering societies.

4. The interest of undergraduate engineering students in the JOURNAL is unknown, but there are some indications it could be developed.

b. *Ethics,* C. J. Freund, Chairman. The Secretary reviewed the activities of the U. S. Chamber of Commerce in

developing a Recruiting Code. It was agreed industry had a voice in the development of ASEE's "Recruiting Practices and Procedures," that ASEE has had a leading role in developing such codes, that a "watering down" of the present code was undesirable, and that the governing principle in all efforts should be having a good code.

c. *Federal Legislation,* H. K. Work, Chairman. President Everitt reported that the Chairman of the Committee requested to appear before the General Council in order to clarify the responsibilities and duties of the committee. The problem specifically pertains to the position the Society should take on influencing federal legislation. Further discussion will be found in the Minutes of the Meeting of the General Council dated June 17 and 22, 1957.

d. *Constitution and By-Laws,* C. A. Brown, Chairman. The Chairman requested the advice of the individual members of the Executive Board regarding continuing vice presidents on the General Council after their terms of office expire. No enthusiasm was expressed. The Chairman also reported that the only matter which may need further deliberation is the status of the position of Editor of the JOURNAL in decision and policy making matters of the Society.

7. *Reports from Divisions*

a. *Relations with Industry,* C. W. Muhlenbruch, Chairman. Copies of the proposed study of "Professional Climate," Appendix "B", were distributed by the Secretary.

8. *Industrial Fellowships.* The need for greater effort to expand this program was stressed. A brochure is now being prepared by the Committee and should be available by October. It was agreed the availability of a brochure is a necessary prerequisite for efforts to increase the number of fellowships.

9. *ASEE–AEC Summer Institutes.* The Secretary reviewed the many difficulties in getting the 1957 Summer Institutes under way. Since the staff paper cleared with the Commission last year cleared the way for future years, no similar difficulties should arise next year. A time-table has been submitted to AEC for making 1958 plans. The inclusion of staff from institutions not having one or more curricula accredited by ECPD was discussed and it was agreed that the programs should be available only to institutions having ECPD accreditation, except for the armed forces' academies. Since AEC and some technical institutes are showing interest in a program on that level, it was agreed that H. R. Beatty should proceed with a determination of actual interest.

10. *Pittsburgh Annual Meeting, 1959.* The Secretary reported on his conferences with personnel at the Carnegie Institute of Technology and University of Pittsburgh, and stated that he believed those in charge should be given authority to plan a different kind of meeting in order to take advantage of the large number of industrial research laboratories in the Pittsburgh area. The Secretary was authorized to so inform the local committee in order that the interest of industry could be explored immediately and a preliminary report submitted at the October meeting of the Executive Board.

11. *Future Annual Meetings.* Two universities in the Southeastern Sec-

tion still are interested in being host for the 1961 meeting.

12. *Bank Resolutions.* The Executive Board voted that signatures on checks be the Secretary, W. Leighton Collins, or the President, F. C. Lindvall, and the Treasurer, John Gammell, or Editor, E. C. McClintock, Jr.

13. *Other Business*

a. The need for an Annual Meeting program to discuss the mechanical, electrical, structural, and other problems encountered in the construction of nuclear reactors and getting them into operation was referred to the Atomic Energy Education Committee with the suggestion that AEC might be interested in cooperating in developing a program for the 1958 Annual Meeting.

b. *Engineering Science Committee.* The establishment of a Society committee was discussed and referred to Vice President Brown for determination of interest.

c. *5th UPADI Meeting.* The suggestion of H. K. Justice that the Evaluation Follow-Up Committee have an additional group established to discuss international aspects of engineering education at the September UPADI meeting in Montreal was discussed. Since the International Relations Committee of ECAC was considering the problem no action was taken.

d. *Report of EJC–ECPD Committee on Practice of Engineering.* Vice President Woodrow reviewed the problem and presented a resolution, Appendix "C", of the Executive Committee of ECRC. The Executive Board *VOTED* to recommend the resolution to the General Council for approval.

e. *ASEE Questionnaires.* Complaints have been received about the large number of complicated questionnaires requiring almost immediate replies that have been sent out in the name of ASEE. In order to improve the coordination of efforts and establish a central clearing house, the Executive Board *VOTED* that the Secretary of the Society be informed of all plans to use a questionnaire or in other ways contact people outside the immediate group doing the work, that he be provided copies of questionnaires used, that the mailing of questionnaires be coordinated in his office, and that copies of the results of any such studies be filed in his office.

14. *Appointment of Secretary.* The Executive Board *VOTED* to appoint W. Leighton Collins Secretary of the Society for one year beginning 1 July 1957.

15. *Appointment of Editor.* The Executive Board *VOTED* to appoint E. C. McClintock, Jr. Editor of the JOURNAL OF ENGINEERING EDUCATION for one year beginning 1 July 1957.

16. *Next Meeting.* The Executive Board *VOTED* to hold its next meeting on Sunday, September 8, 1957 at 10:00 a.m. at the Illini Center on the top floor of the LaSalle Hotel, Chicago, Illinois.

17. *Adjournment.* The meeting adjourned at 11:00 P.M.

Respectfully submitted,

W. LEIGHTON COLLINS
Secretary

Appendix "A"—See Report of the Treasurer, December Journal

Appendix "B"

REPORT OF COMMITTEE ON PROFESSIONAL CLIMATE OF THE RELATIONS WITH INDUSTRY DIVISION OF ASEE

Preamble

The Ninth Annual College-Industry Conference held at the University of California, Los Angeles, in January 1957, passed the following resolution:

Inasmuch as this conference, through its speakers, panels and discussion efforts, has provided much by way of constructive comment regarding the improvement of the Engineer and thus of the Profession:

Therefore be it resolved that this Ninth Annual College-Industry Conference, in meeting assembled, respectfully requests the Relations With Industry Division of the American Society for Engineering Education to consider any means at its command to implement these deliberations with a dedicated plan of action, subject to such ASEE policy as may be applicable.

Further, be it resolved a committee to be appointed by Chairman Carl Muhlenbruch submit a first report on this plan to the Executive Committee of the Society by July 1, 1957.

This report has been submitted to the Executive Committee. It is being presented to the Division in keeping with the Committee's desire to inform as many persons as possible of this project.

Pertinent Conclusions of the UCLA Conference. The two most significant threads of agreement which reappeared throughout the conference were that "Improvement of the Engineer" requires

a) an establishment of true professional status.
b) the support of the professional engineer by a strong, well trained staff of technicians.

Since the second need is being studied by other committees, it was decided that RWI can contribute more advantageously towards the first point. It was concluded that the first step toward the establishment of true professional status for the engineer is the creation of a professional climate.

Appointment of the Committee. At the March 15 meeting of the Steering Committee of RWI, a committee was appointed to implement this resolution. It was decided that this task should be assigned to the Division's Committee on Professional Climate. The membership was increased to the following roster:

Mr. E. E. Bartleson
American Telephone & Telegraph Co.

Dr. R. P. Dinsmore
Goodyear Tire & Rubber Company

Mr. Ralph Emerson
E. I. duPont de Nemours & Co. Inc.

Dr. J. Morley English (Chairman)
University of California

Mr. Donald E. Irwin
General Electric Company

Mr. Stanley Little
Boeing Airplane Company

Mr. Carl W. Muhlenbruch
(Secretary pro tem)
Educational and Technical Consultants, Inc.

The Committee met in Evanston, Illinois, on May 9 after considerable preliminary correspondence. Work since that time and prior to this Annual meeting has also been by correspondence.

Definition. Professional Climate was defined as, "The conscious attitude of associates and management, integrated to stimulate and encourage increased intellectual capacity, moral integrity, acquisition of experience, and effective application of skill and knowledge in the conduct of work, and with due regard for service to society and the enhancement of the profession."

Objectives

The objectives of the Committee are two:

1. Appraise the present status of the Professional Climate for engineers and scientists in educational institutions, employment, and professional societies.
2. Recommend ways and means to improve the Professional Climate in these areas.

Scope

The engineer and scientist is affected by three elements of society in his development to professional stature:

1. His place of education.
2. His place of employment.
3. His professional affiliations.

Therefore, this study will explore aspects of Professional Climate within these elements as follows:

1. Education
   a. Administration
   b. Faculty
   c. Student
2. Employment-Industry
   a. Management
   b. Professional employees
3. Employment-Government
   a. Military
   b. Non-Military
4. Societies
   a. Founder societies
   b. Professional societies
   c. Unions

The Problem

The practical problem confronting the committee is to establish those factors which influence individuals and groups in a way that stimulates the development and growth of professional attitudes and professional behavior. It is therefore necessary to encourage any favorable and discourage any unfavorable practices in the colleges and industry.

It is assumed that the following principles apply:

1) The raising of the professional stature of engineers will be beneficial to society at large. Any special professional climate provided engineers, while unquestionably improving their status in society, primarily will increase their contributions to the community.

2) The productivity or contribution of a professional man cannot be readily measured in terms of his time, skills, etc., and so compensation cannot be related to an output of hours or units of production. Only the man himself can truly assess his own contribution; this imposes a special responsibility on him and distinguishes him from the man whose work is measurable. This establishes the need for a professional attitude.

3) Professional attitude should be developed in the engineer at as early

an age as possible. The time at which the man is identified with the group should be the starting point. It is suggested that the freshman year is a possibility. A professional climate is of utmost importance in college.

4) It is profitable to industry to encourage a professional climate for their engineers. This implies that it will not be economically possible to provide the same conditions of employment for all technical personnel. This in turn poses a dilemma in that a professional climate should be established both in the University and at the professional levels of engineering accomplishment. The young graduate, however, is normally expected to do routine production-type engineering jobs for several years. At present this technician activity does not require a professional climate. At this stage the man's work output is readily measurable. He does not assume a great deal of responsibility for decisions. It is not considered reasonable that there be any time interval in which professional climate is not consciously cultivated. This formative stage of the young engineer's career is perhaps the most crucial in the formation of his future professional behavior.

In respect to the last item, the large proportion of young men who graduate from engineering colleges and never rise above the level of the technician presents a problem in economics. Their situation causes a more costly work environment due to an expectation of high attrition rate. If the number who can expect to achieve professional status is small, compared with the number of graduates from engineering colleges, it will pay to develop an efficient selection process. At what stage this selection should be made is a question which remains to be solved.

Exploratory Work of the Committee

In order to explore ways and means of carrying out the objectives of the committee, the individual committee members agreed to explore the following questions with respect to their own organizations and/or companies:

Interest of Other Organizations. Other groups having an interest in this area have been identified as follows as limited to the activities of EJC and ECPD and their constituent societies:

1. EJC—Committee on Consulting Practice
   EJC—Committee on Employment Conditions of Engineers
2. ECPD–EJC—Joint Committee on Practice of Engineering
   ECPD–EJC—Joint Task Committee on Survey of Engineering Profession
3. ECPD—Recognition Committee
   ECPD—Ethics Committee
   ECPD—Training Committee
4. ASCE—Conditions of Practice Department
5. ASME—Education Division
   ASME—Management Division
6. AWWA—Water Works Management Division
7. AIEE—Education and Management Committee
8. ASEE—Relations with Industry
   ASEE—Development of Engineering Faculties
   ASEE—Loss of Faculty to Industry
   ASEE—Recognition and Incentives for Good Teaching
   ASEE—Committee on Ethics

9. ASRE—Professional Development Committee
   ASRE—Industrial Relations Committee
10. AIChE—Professional Development Committee
11. NSPE—Consulting Engineers in Private Practice
    NSPE—Engineers in Government
    NSPE—Engineers in Education
    NSPE—Engineers in Industry
    NSPE—Engineers in Employ of Private Practitioners
    NSPE—Engineering Practices Committee
    NSPE—Ethical Practices Committee

Competition as a Means of Promoting a Better Professional Climate in Industry.

1. Select a group of not less than five and no more than ten companies which have shown outstanding interest in improving the professional status of engineers.

2. Address a letter to the President or to the Vice President in charge of engineering covering the following:

A. A satisfactory climate is essential for the effective performance of truly professional engineers. These engineers are and always will be in short supply even though they are among the most important factors in industrial and social progress.

B. This company has shown an understanding of the necessity for a good Professional Climate.

C. Ask for a statement of policy (or philosophy) that has been found helpful in promoting and maintaining an atmosphere in which engineers and scientists enjoy working. This will be used for two purposes: first, to combine with the corresponding information from other advanced-thinking companies in order to make the best thinking available to those who are interested in this subject and, second, as public acknowledgment of how the company performs in this area (if company so desires).

State that committee will not use name of company in connection with this material or any statement which may result from it without first getting approval of the manner in which it is used, together with the complete context.

3. When sufficient data have been received from industrial concerns, they will be classified and summarized and incorporated into a presentation of the preferred method of company approach in which the names of the contributing companies are to be included.

4. Arrange for wide publicity and dissemination of the printed matter.

Meeting as a Means of Exploring the Subject. The consensus of many groups will be necessary to fully explore the subject. Arrangements will be made to introduce discussions and papers on Professional Climate to groups such as:

1. Professional society general session type meetings
2. Engineering college student chapter meetings
3. Management societies
4. Management training programs
5. Trade associations
6. Manufacturers organizations
7. Nationwide clinics on utilization of engineers.

It is hoped that a comprehensive general session can be sponsored at next year's ASEE Annual Meeting or at the ECPD meeting in the fall of 1958.

Several exploratory meetings have been conducted thus far.

A meeting was held with the Student Relations Committee for the Department of Engineering of UCLA for the purpose of determining the factors that influence the development of professional climate insofar as

(1) the actions of the man are concerned
(2) the actions of the group are concerned.

This discussion occurred at a timely moment because the question of ethics of examinations was being reviewed.

The committee was receptive to the concept of a professional climate for undergraduate students. It was generally agreed that in order to develop the professional attitude among students it is essential that a number of basic principles be observed:

1) You do not teach students professional attitude or, for that matter ethics by merely stating a code and then having them memorize a set of rules.

2) Students will learn from example and observation of their elders in the profession. Therefore, it is important that they recognize that the faculty has a professional attitude; the climate that is being engendered for them is representative of that under which the faculty operates.

3) A significant and important factor that will work toward development of professionalism among students is that of close and rather constant relationship with faculty, apart from, as well as in relation to, courses. This is not achieved by a simple expedient of maintaining a low student-faculty ratio, but must also be developed by conservation of faculty time in order to afford more opportunity for close and constant contact with students. It was observed that the trend in engineering education seems to be in the opposite direction. Students are becoming more plentiful, faculty are becoming more scarce, and the demands in the nature of busy work that it imposes upon the professors is such that there is less time left for working with students than is desirable.

Another meeting was undertaken in conjunction with the Education Committee of the Structural Engineers Association of California. Work is progressing on consideration of the problem of development of professional climate in structural engineering activities. It is recognized that the problems confronting the structural engineer are somewhat different in many respects from that of other engineering activities. They are different primarily in regard to the ratio of numbers of engineers engaged by the small private consulting firms, the fluctuating work loads these offices encounter, and perhaps most significantly the need to utilize engineers on the whole spectrum of engineering activities, much of which may too often be considered the function of the technician.

CARL W. MUHLENBRUCH,
Secretary Pro Tem

Appendix "C"

RESOLUTION REGARDING THE PROPOSAL OF THE EJC–ECPD JOINT COMMITTEE ON THE PRACTICE OF ENGINEERING RELATIVE TO CORPORATE PRACTICE

Be it resolved that the General Council of the American Society for Engineering Education does not concur with the proposal of the EJC–ECPD Joint Committee on the Practice of Engineering, as referred to ASEE by the EJC, concerning the practice of engineering by corporations. Specifically, the Council believes that it is undesirable, not in the interest of the public welfare, and inconsistent with the concepts of individual professional practice and responsibility, to require that a majority of the officers and a majority of the directors of corporations shall be registered professional engineers in the state of incorporation for a corporation to be allowed to offer and render engineering services.

In support of the above resolution, it is pointed out that: repeated court decisions have stated that individuals are examined and licensed; that individuals, in fact, render engineering services as defined in the Model Law; that corporations, as such, cannot be examined, cannot demonstrate qualifications, cannot practice; but that individuals—singly, in partnership, in association, or in a corporate structure —can and must be responsible for the practice of engineering.

The philosophy of legislation, such as the Model Law, concerning professional registration of engineers is based on the promotion of the public welfare by safeguarding life, health, and property. There is no evidence that the certification of corporations by methods such as requiring the professional engineering registration of officers and directors would promote the public welfare. In fact, it appears that the public welfare would suffer by denying to many corporations the right to practice engineering, and to perform research and development which seem to fall within the definition of engineering services, which the personnel of these corporations as individuals may be fully qualified to perform.

With particular reference to engineering colleges, the proposal of the EJC–ECPD Joint Committee might make it mandatory for a majority of the officers and directors, trustees, or regents of our educational institutions to be registered professional engineers if engineering research as now conducted by these institutions is to be continued. This is obviously not feasible.

66TH ANNUAL MEETING

University of California, Berkeley

JUNE 16-20, 1958

MINUTES OF THE GENERAL COUNCIL MEETINGS

Cornell University, Ithaca, New York

June 17 and 21, 1957

A meeting of the General Council of the American Society for Engineering Education was held in the Elmhirst Room of Willard Straight Hall, Cornell University on June 17 and continued at a luncheon meeting in the Kimball Room of the same building on June 21, 1957. President W. L. Everitt presided.

Those present on June 17 only were:

Name	*Representing*
L. V. Bewley	Electrical Engineering Division
M. M. Boring	Past President
R. S. Burington	Mathematics Division
E. T. Donovan	New England Section
N. W. Dougherty	Past President
H. Flinsch	Southeastern Section
L. E. Grinter	Past President
J. O. Hougen	Chairman, Chemical Engineering Division
C. S. Jones	Technical Institute Division
H. K. Justice	Ohio Section
K. Kobe	Chemical Engineering Division
E. K. Kraybill	Educational Methods Division
R. J. Seeger	Physics Division
J. S. Wohlford	Cooperative Engineering Education
H. K. Work	Federal Legislation Committee

Those present on June 17 and 21 were:

W. T. Alexander	Vice President of ECAC
Henry H. Armsby	National Capital Section
N. H. Barnard	Kansas-Nebraska Section
G. F. Branigan	Missouri-Arkansas Section
C. A. Brown	Vice President—Divisions
R. M. Campbell	Upper New York-Ontario Section
N. A. Christensen	Graduate Studies Division
W. Leighton Collins	Secretary of ASEE
Renato Contini	Secretary of ECRC
V. L. Doughtie	Southwest Section
A. B. Drought	North-Midwest Section
W. L. Everitt	President of ASEE
Walton Forstall	Allegheny Section
C. O. Frush	Mineral Engineering Division
John Gammell	Treasurer
E. L. Grant	Pacific Southwest Section
F. A. Heacock	Engineering Drawing Division
A. R. Hellwarth	Relations With Industry Division
J. W. Howe	Mechanics Division
A. Lesser	Engineering Economy Division

Name	*Representing*
F. C. Lindvall	Vice President for Sections
E. C. McClintock, Jr.	Editor
B. J. McMinn	Mechanical Engineering Division
R. A. Morgen	Vice President of ECAC
R. G. Owens	Illinois-Indiana Section
R. L. Peurifoy	Civil Engineering Division
J. H. Pitman	English Division
L. A. Richardson	Architectural Engineering Division
W. M. Richtmann	Rocky Mountain Section
C. E. Schaffner	Evening Engineering Education Division
W. I. Short	Allegheny Section
R. D. Sloan	Pacific Northwest Section
D. G. Stillman	Humanistic-Social Division
R. W. Van Houten	Middle Atlantic Section
R. J. Woodrow	Vice President of ECRC

Those present on June 21 only were:

T. R. Cuykendall	Physics Division
E. T. Donovan	New England Section
C. G. E. Downing	Agricultural Engineering Division
D. W. Dutton	Southeastern Section
E. C. Easton	Middle Atlantic Section
C. L. Eckel	Vice President of Sections—West
E. K. Hamlen	Cooperative Engineering Education Division
E. F. Littleton	New England Section
Glenn Murphy	Vice President of Divisions—General
B. H. Norem	Industrial Engineering Division
S. P. Olmsted	Humanistic-Social Division
K. W. Riddle	Evening Engineering Education Division
J. F. D. Smith	Relations With Industry
H. I. Tarpley	Educational Methods Division
K. O. Werwath	Technical Institutes Division
H. E. Wessman	Secretary ECAC
D. E. Whelan, Jr.	Chairman, Pacific Southwest Section

1. *Report of the Secretary,* W. Leighton Collins. The reports of the Secretary, Vice Presidents, Treasurer, and Editor (otherwise appendices G to K), will be printed separately.

a. *Membership Summary.* The membership status as of 30 June, 1957 will be:

	1956	*1957*
Individual members	7318	7986
Active institutional	149	148
Associate institutional	123	141
Affiliate	36	39

364 individual members are delinquent one year's dues, as compared to 352 last year and 917 two years ago.

b. *Approval of New Individual Members.* The General Council *VOTED* to approve the 20 applicants for individual membership on List No. 18. This is the last approval to be granted by the General Council; the revised constitution makes approval the responsibility of the Executive Board.

c. *Life Memberships.* The General Council *VOTED* to grant life membership to nine members, each of whom meets all of the requirements of the Constitution for life membership.

d. *Drops from Membership for Non-Payment of Dues.* The General Council voted to drop from membership, as of 1 July 1957, those of the 178 members who are still two years delinquent on that date. The list of names may be obtained from the Secretary. It is significant to note that 43 members paying $6.00 per year now are delinquent for two years, whereas last year only one was delinquent for two years.

e. *Deceased Members.* There were 46 deaths during the year. The General Council *VOTED* that appropriate words of condolence, on behalf of the Society, be expressed to the family of Past President (twice) Harry S. Rogers.

f. *Resignations.* 208 members resigned during the year; last year the number was 297.

g. *Addresses Unknown.* There are 12 members who are not delinquent in dues for two years, but whose addresses are unknown, as determined by the return of first class mail.

h. *Membership Drive.* This has been a project of the CYET's, with a YET at each institution supposed to conduct a drive. Wherever such a man was named, a letter from the Secretary's office went to his dean asking for cooperation. Only about 30 per cent of the member institutions had such a YET, and how each of those appointed functioned is indeterminate. In order to maintain a balanced budget for next year it is important that membership be expanded and that every General Council Member do his part in assuring a successful campaign at his institution.

i. *YET Paper Contest.* In quality of papers submitted, the contest was an improvement over last year. Only 12 Sections submitted papers, one being received too late for consideration. Some also reported that only one entry had been received. Representatives of Sections on the General Council should aid in conveying the idea to Section officers that each Section has the responsibility of promoting a contest.

j. *ASEE–AEC Summer Institutes.* The long delay in getting the program under way was not the fault of ASEE. 64 applications were received for the 30 places available in the basic course at Brookhaven. None of the advanced courses were filled. Efforts were made to up-grade as many as possible, the final result being that 81 of the 104 applicants were accepted. (See "Report of the Secretary," Item 19g for additional details.) Plans are now being developed for 1958.

k. *Actions of the Executive Board.* Pertinent actions of the Executive Board taken since the last General Council meeting were reviewed.

2. *Report of Treasurer,* John Gammell.

a. *Pro-forma Statement for 1956–57.* The statement was distributed and reviewed. A favorable balance of about $8000 is indicated for the year's operations.

b. *Budget for 1957–58.* The budget accompanying the pro-forma statement was reviewed. A continued expansion of individual and industrial members and an increase in advertising income is required if the budget for the year is to be balanced.

3. *Report of Vice President in charge of Instructional Division Activities,* C. A. Brown. The results of the study of intra-divisional communication are worthy of study. An added item was a plea for Divisions to jointly sponsor sessions at meetings of appropriate professional societies, such as

the Civil Engineering Division at an ASCE meeting.

4. *Report of Vice President in charge of General and Regional Activities,* F. C. Lindvall. Of particular significance is the resume of the annual reports of all Sections giving information on attendance, financing, and programs. It also was announced that the "Manual for Section Officers" would be revised to bring it up-to-date.

5. *Report on ECAC Activities,* W. T. Alexander. The report summarizes Council and Committee activities for the year. The new officers elected for next year were announced as:

R. A. Morgen, Purdue University, Chairman
H. E. Wessman, University of Washington, Secretary
A. T. Granger, University of Tennessee, Executive Committee
R. H. Roy, Johns Hopkins University, Executive Committee

6. *Report on ECRC Activities,* R. J. Woodrow. The report summarizes Council and Committee activities for the year. The new officers elected for next year were announced as:

R. G. Folsom, University of Michigan, Vice President
C. C. Chambers, University of Pennsylvania, Director
C. A. Dunn, Oklahoma State University, Director

The Research Review will be available from the ECRC Secretary in late summer at $2.00 per copy. The research projects listed have a value of over $100,000,000. A history of ECRC also will be included.

7. *Report of the Editor,* E. C. McClintock, Jr. The report summarizes the major changes and progress made during the year. A 14-page "Author's Manual" has been prepared and is available from the office of the Editor. Cooperation of division editors and officers is improving and is necessary if the *Journal* is to be representative of all aspects of the Society's work and members' interests.

8. *Reports of Committees.*

a. *Constitution and By-Laws,* C. A. Brown, Chairman. All of the proposed changes in the Constitution were approved by letter ballot of the membership and all the proposed changes in the By-Laws were approved by the members of the Society at the regular meeting held on June 19, 1957. Consequently all changes are immediately effective.

The comments accompanying returned ballots indicated some undesirable features of Article IV—Officers, the last two sentences. The General Council *VOTED* to amend the Constitution, Article IV—Officers, replacing the last two sentences of that article by, "In the case of a vacancy in the office of the President, succession shall be first, to the elected Vice President for Sections having the least remaining service in office and second to the elected Vice President for Divisions having the least remaining service in office."

In asking for opinions regarding continuing Presidents of the Society on the General Council for more than three years, the general concensus was that other appointments could make more effective use of their abilities and backgrounds.

b. *Federal Legislation,* H. K. Work, Chairman. Dr. Work reported that his committee has been keeping informed on legislation introduced affecting education. Fifty or more bills have been introduced in the current session of Congress. No Scholarship bill probably will be passed in the

current session, but hearings on some may soon get under way. The Committee also has been following the actions of the Land Grant Association, American Council on Education, National Association of Manufacturers, National Society of Professional Engineers, etc. As a result of its deliberations the Committee presented three questions, the answers to which influence the future work of the Committee.

1. Should ASEE establish a policy on federal aid to education?
2. What should such a policy be?
3. Who should or how should such a policy be established?

An hour-long discussion followed, most of the comments centering around the tax exempt status of the Society, what constituted "infiuencing of legislation," and whether any group could or should speak for ASEE on matters such as this. The General Council *VOTED* that the Executive Committee of the Engineering College Administrative Council should study the reports of the Federal Legislation Committee, that information believed to be important to the Institutional Members of the Society be reported to them, and that items involving policy and requiring action on the part of the General Council be presented to the General Council.

After further discussion of whether ASEE should adopt and state policies, the General Council *VOTED* (with three negative votes) that the question of establishing a Society policy on federal legislation be referred to the Policy Committee of the Society for study, that if the formulation of a policy be deemed desirable a mechanism for determining it be recommended, and that a preliminary report be submitted to the General Council at its October 1957 meeting.

c. *Degree Designation,* J. H. Sams, Chairman. Because it had completed its work the Committee requested that it be discharged. The General Council *VOTED* to discharge the Degree Designation Committee and thank it for its efforts.

d. *Recognition and Incentives for Good Teaching,* Philip Nudd, Chairman. Because the objectives of the Committee are included among those of the new Committee on Development of Engineering Faculties, the Committee prepared a report and requested that it be discharged. The General Council *VOTED* to discharge the Committee on Recognition and Incentives of Good Teaching, to thank the members for their efforts, and to accept the report. Copies of the report were distributed; it is not included as an appendix because it will be published separately.

e. *YET Summer Institute,* W. T. Alexander, Chairman. The report (see Appendix "L") states a survey of the opinions of those participating in General Electric's summer program will be made prior to developing plans for 1958. The General Council *VOTED* to continue the committee for another year.

f. *Style Book,* G. J. Christensen, Chairman. The Chairman of the Committee requested, in a letter to C. A. Brown dated 13 June, 1957, that the Committee be discharged pending a demonstration of future need for reactivation. The reasons are the imminence of a superior manual and a resulting lack of interest in the project. The General Council *VOTED* to discharge the Style Book Committee and to thank it for its efforts.

g. *Technical Institute Education* (Book), H. P. Adams, Vice Chairman. The Acting Chairman, S. C. Hollister, submitted a written report recommending a change in the committee's work, from a "book writing" objective to an "awards for papers" objective. The General Council *VOTED* to approve the report in principle, refer it to the Awards Procedure Committee for the working out of details, and that the plan should be coordinated with the work of the Technical Institute Division. (See Appendix "M.")

h. *Loss of Faculty to Industry,* A. R. Hellwarth, Chairman. The annual report of the committee was briefly reviewed, the Chairman indicating close cooperation with the Committee on Development of Engineering Faculties and outlining plans for the use of a questionnaire to determine from the men themselves *why* they left teaching to go into industry.

i. *Industrial Fellowship,* K. B. McEachron, Jr., Chairman. R. A. Morgen reported on plans and the General Council *VOTED* to approve the printing of a brochure for publicizing the fellowship plan and for soliciting additional fellowships, provided the Executive Board is able to provide the necessary funds.

j. *Atomic Energy Education,* P. N. Powers, Chairman. Glenn Murphy reported that plans for 1958 Summer Institutes, in cooperation with the Atomic Energy Commission, were under way. The General Council *VOTED* to continue the Summer Institutes in 1958 in accordance with the general plans for 1957.

9. *Reports from Divisions.* None.

10. *Reports from Sections.*

a. *Southeastern.* Harold Flinsch reported that a liaison member had been reappointed for each Division of the Society because the practice has enabled the Section to better understand the work of the Divisions. He also reported that no paper was submitted for the YET Paper Contest because no paper submitted was judged to be good enough for such consideration.

11. *Report on Humanistic-Social Summer Institute for 1958,* G. A. Gullette, Chairman. In the absence of the Chairman, D. G. Stillman presented the report (not printed at this time because of its preliminary character). The National Science Foundation was approached and declined financing the project because of its limited scope. As a result of the NSF negotiations it was agreed the term "seminar" is better because "institute" is so firmly related to the high school teachers' programs. The "history and philosophy of science" was the proposed title of the seminar. The discussion led to the agreement that "and engineering" should be added to the title. Further discussion indicated that if funds were granted for the seminar that much less money would be available for NSF allocation to engineering research. The General Council *VOTED* that the National Science Foundation be approached from the point of view that although the Society anxiously desires the financing of the "Seminar on History and Philosophy of Science and Engineering," the grant should not come from funds intended for engineering research.

12. *Survey of Teaching of English in Colleges of Engineering.* C. A. Brown, Chairman. Financing is still being sought; plans are complete.

13. *Conference on Higher Education in Engineering and Science.* President Everitt reviewed the initial

planning of the Conference, sponsored by EJC's Engineering Manpower Commission, the Scientific Manpower Commission, the National Science Foundation, and the National Research Council. It is to be held in Chicago Oct. 31 through Nov. 2. Objection was raised to the initial omission of ASEE as a sponsoring agency because it is firmly believed ASEE, as the spokesman for engineering education, should have a leading role in the planning of any conference dealing with engineering education; omission is considered to be a serious error of judgment. Though it was then agreed that ASEE would be listed as a cooperating organization, subsequent publicity made no mention of ASEE. The continued omission was admitted to be a blunder, but even the latest publicity of EJC ignores ASEE except as a member of EJC.

14. *Summer Schools for 1958.*

a. The General Council *VOTED* to approve the request of the Civil Engineering Division to sponsor a summer school on construction for the Friday afternoon and Saturday following the Annual Meeting.

b. The General Council *VOTED* to approve the request of the Mechanics Division to sponsor a summer school in conjunction with the 1958 Annual Meeting.

15. *Future Annual Meetings.* Places and dates definitely approved are:

1958—University of California at Berkeley, June 16–20
1959—Pittsburgh, Carnegie Institute of Technology and the University of Pittsburgh, June 15–19
1960—Purdue University
1961—The Annual Meeting Committee still is deliberating its recommendation.

16. *Other Business.*

a. *Resolution of ECRC on Salaries and Working Conditions.* For the information of the General Council, R. J. Woodrow read the resolution, Appendix "O," It pertains to an improvement of salaries, working conditions, etc. to retain and attract personnel required for the conduct of teaching and research programs in colleges of engineering. ECRC has distributed copies to representatives of active institutional members.

b. *ECRC Resolution Regarding the Proposal of the EJC–ECPD Joint Committee on the Practice of Engineering Relative to Corporate Practice.* R. J. Woodrow presented a resolution prepared by the Executive Committee of ECRC and recommended by the Executive Board of the Society for approval by the General Council. The resolution expressed disapproval of the requirement of the EJC–ECPD Committee report that a majority of the officers and a majority of the directors of corporations shall be registered professional engineers in the state of incorporation for a corporation to be allowed to offer and render engineering services. It is believed the proposal of the EJC–ECPD Committee might make it mandatory for a majority of the officers and directors, trustees, or regents of educational institutions to be registered professional engineers if engineering research as now conducted by these institutions is to be continued. The General Council *VOTED* to approve the resolution of the ECRC Executive Committee, attached to the Minutes of the Meetings of the *Executive Board,* June 16 and 19, 1957, as Appendix "C".

c. *Attendance at Annual Meetings.* C. A. Brown reported that attendance

figures indicated the following increases in out of town attendance as compared to last year: men 5%; women, 25%; children, 40%. The total of women and children was about one-third of the total number attending. The Society's meetings are gaining a wide reputation as family meetings and from many points of view this is desirable. However, the increasing number of women and children places a larger burden on the local committee, for it must plan and finance the programs. Questions of budget and professional assistance are intimate parts of the problem. The General Council *VOTED* to refer the problem to the Annual Meeting Committee for study and recommendations.

d. *Journals of Engineering Education for Students.* E. C. McClintock reported he had observed some interest in making copies of the JOURNAL available to students, particularly on the graduate level, at a reduced rate. The objective is to interest students in careers in engineering teaching. The General Council *VOTED* to authorize the Editor and Secretary to proceed with the establishment of a nominal price, on the order of $1.50 per year, for the bulk mailing of JOURNALS to individual members for distribution to students; at the end of a one-year trial a report is to be submitted to the General Council.

e. *Correspondence with the President.* President-elect F. C. Lindvall requested that a carbon copy of all Society correspondence directed to him be sent to the Secretary, and stated he would send copies of his correspondence to the Secretary.

f. *Meeting of Nominating Committee.* In order to comply with the provisions of the revised Constitution and By-Laws, the Nominating Committee (the three Junior Past Presidents and General Council members elected by Sections and Divisions whose terms expire in the year in which the Annual Meeting is held) will have a luncheon meeting in New York City on Saturday, October 26, 1957 at 1:00 p.m. in the Sutton Room of the Hotel Statler.

17. *Resolutions.*

a. *To Host Institution.* The resolution unanimously adopted at the Annual Banquet on Thursday, June 20, was officially spread on the minutes. (See Appendix "P.")

b. *To Officers, Divisions, Committees, etc.* The General Council *VOTED* to have the Secretary prepare and mail appropriate resolutions to officers, divisions, committees, and institutions responsible for Summer Schools, Conferences, and Institutes.

18. *Fall Meeting.* The General Council *VOTED* that its next meeting will be in New York City, on October 26, 1957. The meeting will be a breakfast meeting at 8:00 a.m. in the Dallas Room of the Hotel Statler. Travel expenses will be paid for non-industry members of the General Council provided they cannot have expenses paid in other ways. The Executive Board meets on the previous evening and both meetings immediately follow the Annual Meeting of ECPD. (See Item 16f for meeting of Nominating Committee.)

19. *Adjournment.* President Everitt thanked the members of the General Council for their work during the year and adjourned the meeting at 2:30 p.m.

Respectfully submitted,

W. LEIGHTON COLLINS,
Secretary

Appendix "L"

REPORT OF YET SUMMER INSTITUTE COMMITTEE (AD HOC)

W. T. ALEXANDER, CHAIRMAN

At the last Annual Meeting of the Society an *ad hoc* committee was appointed to attempt to establish a summer institute for YETs in 1957.

Early in the Fall steps were initiated to determine the type of institute desired by the YETs and to see where such a program could be held. Much thought and effort was devoted to this by Professors Artley, Boyle, Foecke, Kraybill, and others, culminating in formal proposals from Duke University and from Purdue to hold institutes on its campus. In the meantime, the General Electric Company decided to convert their well established summer "Professors' Conference" into a program for YETs. This plan provided for full summer employment of about 30 YETs by General Electric, with a two-week period devoted to a study of educational matters of interest to young teachers. It was contemplated that the two-week conference on education would be held away from the plan in some appropriate quiet location. This plan will be in full operation this summer. Additional YETs who could not be accommodated, or who were not free for the entire summer, have been invited to attend the two-week conference.

Heretofore much uncertainty has existed concerning the following aspects of the problem; the actual availability of YETs for summer programs of this nature, the most acceptable type of program, its proper length, and the availability of funds from foundations or from industry to underwrite the expenses involved. As a consequence, there has not been unanimity of opinion among the YET officers, members of this committee, individual YETs, and the Executive Board, regarding a sound summer institute program.

A major accomplishment this year has been a survey of the YET membership recently made by Thomas A. Boyle. This clearly indicates widespread interest in the summer institute concept and expresses a clear preference for a relatively short conference for the study of YET problems.

The General Electric Company deserves much credit for initiating a valuable YET summer program which, it is hoped, will be adpoted by other companies throughout the country.

The "1957 GE YETs" should be surveyed individually in the Fall and based upon their reactions, and upon the replies to Mr. Boyle's 1957 survey, intelligent decisions can be made and effective action initiated for 1958.

It is recommended that this ad hoc committee be continued through 1957–58.

Appendix "M"

REPORT OF TECHNICAL INSTITUTE EDUCATION COMMITTEE

VICE-CHAIRMAN H. P. ADAMS

On Tuesday, June 18, 1957, Vice-chairman H. P. Adams presided at a meeting of the Committee on Technical Institute Education of the Amer-

ican Society for Engineering Education to consider ways of carrying on the work of the committee following the death of Chairman Arthur L. Williston. Members present were Dean S. C. Hollister, Dean M. R. Graney, and Jeanne Miller.

The original objective of the committee was the preparation and publication of a volume on technical institute education. The history, changing philosophy, and changing educational structure of technical institutes was to constitute a major part of the volume. Chairman Williston was engaged in preparing the material for committee consideration. The completed material is not in sufficient volume to warrant publication, and the committee now has no writer to finish the job.

The committee believes that to employ a competent writer to complete the work would require several times the amount of money available. The committee is, however, sympathetic to the idea of setting forth an accurate record of the development, structure, philosophy, and operation of technical institute education. The committee strongly recommends, therefore, that a method be devised to accomplish as nearly as possible its original objective.

1. The committee believes that this may be done by using the income from Mr. Williston's gift to the Society to encourage the writing of papers setting forth the history, the philosophic objectives, and the structure and operation of technical institutes in the changing times.

2. The committee believes this can best be done by offering an annual prize in the amount of $200 or $250 for the outstanding paper meeting the above objectives and recommends that the Society publish the winning papers in the JOURNAL OF ENGINEERING EDUCATION.

3. The committee recommends that the prize be presented at the annual banquet of the Society.

4. The committee believes that its function should be largely confined to the selection of the winning paper each year and that it should have the authority to recommend no award if in its judgment the situation in any year warrants such action. If a committee member submits a paper, he should absent himself from the consideration of that paper.

5. The committee recommends that the award be called the Arthur L. Williston Award for the Outstanding Paper in Technical Institute Education, under the above objectives.

6. The committee is strongly against the disposition of the principal sum in any way other than along the lines set forth above.

7. The committee believes that it would be appropriate to the intent of Mr. Williston's gift to develop as early as possible the historical background of technical institutes while there are still available men who have first-hand knowledge of the early operation of technical institutes.

Because of his imminent departure from the country for a two-year period, Professor Adams asked that a new chairman be selected. The committee moved that Dean Hollister take over the chairmanship. He agreed to serve as temporary chairman of the committee pending the appointment of a new chairman by the president of the Society.

The committee then moved to reorganize in line with the structure and operation of similar committees of the

Society, giving the president of the Society authority to appoint a new chairman and to select the committee members. This committee should be a standing committee of the Society. It is further suggested that the following members of the original committee be carried over—Dean S. C. Hollister, Dean M. R. Graney, B. K. Thorogood, and Jeanne Miller—and that the committee be expanded to five members.

Appendix "O"

RESOLUTION OF ECRC EXECUTIVE COMMITTEE

"Item 4. Research Administration" of ECRC Minutes dated June 18 and 19, 1957.

"Whereas the Engineering Colleges through their programs of engineering research are making substantial and significant contributions to the discovery of new knowledge, the development of industry, our economic progress and the defense of our country; and

Whereas these engineering research programs involve the responsibility for the expenditure of more than one hundred million dollars per year, and require the services of highly competent engineers and engineering scientists for their performance; and

Whereas these same engineering colleges are also responsible for the education of prospective engineers and endorse the principle of the integration of engineering research and teaching programs for the benefit of both; and

Whereas the competition being offered by other organizations in the country for competent engineers and engineering scientists continues to increase;

Be it therefore resolved that every logical action should be taken—through improved salaries, working conditions, and other means—to retain present staff and attract necessary new personnel of the calibre required for the conduct of these engineering college teaching and research programs which are so essential to the future of our country."

Appendix "P"

THE COMMITTEE ON RESOLUTIONS—65TH ANNUAL MEETING AMERICAN SOCIETY FOR ENGINEERING EDUCATION

RECOMMENDS that the Society adopt the following:

We express the sincere appreciation of the American Society for Engineering Education to the many persons who have contributed so generously of their talents, their time, and their energy to make the Sixty-Fifth Annual Meeting a distinctive landmark of achievement.

We are deeply indebted to Dr. Deane W. Malott, President of Cornell University, for making available to the Society a most beautiful campus, many fine buildings, services, and facilities

and particularly the effective contributions of a congenial and able faculty.

We are grateful to Professor J. C. Gebhard, General Chairman of all local committees, and to the faculty and staff of the University for effective planning and splendid conduct of the great number and diverse variety of events.

We also want to express our thanks to Co-chairmen Mrs. H. H. Mabie and Mrs. C. L. Cottrell and all the ladies who worked so well with them for the excellent Women's and Young People's programs planned for the comfort and pleasure of our wives and children.

The members of the Society are especially indebted to President William L. Everitt, the National Officers, Council Members, Division and Committee Chairmen, and the Headquarters Staff for the planning and conduct of the technical sessions.

We appreciate the content and quality of the noteworthy papers presented by so many speakers. These papers are bound to stimulate creative thinking and add significant contributions to the advancement of Engineering Education.

We are genuinely appreciative of the warm reception accorded us. We congratulate the local committee for its ability to maintain this warm cordiality and at the same time introduce a most welcome moderation in temperature.

The Committee recommends that these Resolutions be made a part of the Minutes of the Sixty-Fifth Annual Meeting, and that copies be sent to all persons mentioned in these statements.

Respectfully submitted,

COMMITTEE ON RESOLUTIONS

G. F. BRANIGAN,
H. K. JUSTICE,
FRANK KEREKES, *Chairman*

TEACHING POSITIONS AVAILABLE

The Teaching Positions Available department is published as an opportunity and convenience for Active and Affiliate Institutional Members. By action of the General Council, a nominal charge per line is made. Inquiries about rates, replies to coded advertisements, and correspondence concerning the department should be directed to the JOURNAL, 114 Civil Engineering Hall, University of Illinois, Urbana.

MECHANICS AND MATERIALS OR Highways openings in Civil Engineering Department for individuals with experience and/or advanced degrees. Desire staff interested in developing undergraduate, gradaute, and research programs. Engineering enrollment 1500 and growing rapidly. Ideal college town of 12,000 population in West. Scenic mountains, good hunting, fishing, and skiing. Salary open. Send transcript, letter of inquiry and references to Head of Civil Engineering, Montana State College, Bozeman, Montana.

ELECTRICAL AND MECHANICAL Engineering positions open. Teaching assignments are Electric Power, Electronics, Mechanical Vibrations, Fluid Mechanics, and other Mechanical Engineering subjects. Salary depends upon qualifications. Excellent fringe benefits. M.S. in Electrical or Mechanical Engineering desired. Applicants with B.S. considered. Write to Earle M. Morecock, Chairman, Applied Science Division, Rochester Institute of Technology, Rochester, New York.

(*Continued on p. 156*)

NEW MEMBERS OF ASEE

ALDRICH, H. LAMAR, Assistant Professor of Mechanical Engineering, University of Dayton, Dayton, Ohio. M. R. Graney, W. J. Luzadder. Divisional Interest: E. Draw., I. E. Shop and Mech. Arts.

ANDERSEN, BLAINE W., Stress and Vibrations Engineer, Preliminary Design, Airearch Manufacturing Co. of Arizona, Phoenix. W. Leighton Collins, M. C. Steele. Divisional Interest: M. E., Mech. and Mat.

ANDERSON, KENNETH R., Chairman, Humanities Department, Academy of Aeronautics, LaGuardia Airport, Flushing 71, N. Y. C. H. Coder, Jr., R. J. Wear. Divisional Interest: English, Human.-Soc. Stud.

ANDERSON, RICHARD J., Manager, Staff Education, Battelle Memorial Institute, Columbus, Ohio. H. P. Munger, E. C. Clark. Divisional Interest: Staff Education Program, Geology.

ALLEN, J. S. V., Head, Department of Physics, Bethany College, Bethany, W. Va. W. L. Everitt, W. L. Collins. Divisional Interest: Plan Coordinator, Physics.

BALL, HERBERT D., Graduate Assistant in Mechanical Engineering, University of Nebraska, Lincoln. J. M. Vickers, J. W. Harper.

BENEDICT, GEORGE W., Manager, North American Aviation, Inc., 485 Lexington Avenue, New York 17, N. Y. W. L. Everitt, W. L. Collins. Divisional Interest: Personnel, G. E.

BOULET, J. LIONEL, Director, Electrical Engineering, Laval University, Quebec, Canada. G. F. Tracy, J. M. Ham.

CARR, CHARLES R., Associate Professor of Mathematics, Indiana Technical College, Fort Wayne. R. R. Marshall, R. W. Young. Divisional Interest: Math.

CLIETT, CHARLES B., Professor of Aeronautical Engineering, Mississippi State College, State College. C. Scott, H. Flinsch. Divisional Interest: Aero. and Aero. E.; Mech. and Mat.

DAVENPORT, WILLIAM H., Professor of English and Chairman of Department of Humanities, Harvey Mudd College, Claremont, Calif. D. G. Stillman, W. C. Laity. Divisional Interest: English, Human.-Soc. Stud.

DE JONG, SYBREN H., Associate Professor of Civil Engineering, University of British Columbia, Vancouver 8, Canada. B. A. Barry, V. J. Vitagliano. Divisional Interest: C. E., E. Draw.

DUNN, PAUL JOSEPH, Training Officer, U. S. Naval Research Laboratory, Washington, D. C. J. Harms, K. C. Harder. Divisional Interest: Admin.-Educ., Coordinators of Coop. Engr.

ECKSTROM, HILDING T., Manager, Industry Educational Relations, Minneapolis-Honeywell Regulator Company, 2753 4th Avenue, South, Minneapolis, Minn. R. L. Goetzenberger, R. C. Jordan. Divisional Interest: Admin.-Ind., Human.-Soc. Stud.

EWING, S. BLAINE, Associate Professor of English, Lehigh University, Bethlehem, Pa. F. E. Myers, R. T. Gallagher. Divisional Interest: English, Admin.-Educ.

FAIRMAN, FLOYD I., Vice President, Customer Service and Advertising, Kentucky Utilities Company, 120 S. Limestone Street, Lexington, Ky. M. Baker, D. V. Terrell. Divisional Interest: Admin.-Ind., I. E.

FOPMA, ROBERT J., Assistant Professor of Mathematics, University of Cincinnati, Cincinnati, Ohio. W. E. Restemeyer, H. K. Justice. Divisional Interest: Math., Mech. and Mat.

FOWLER, RICHARD G., Chairman, Department of Engineering Physics, University of Oklahoma, Norman. W. H. Carson, E. F. Dawson.

FRAZIER, DOZIA N., JR., Graduate Student; Registered Professional Engineer, 7344 Lemington Avenue, Pittsburgh 6, Pa. F. T. Mavis, Dr. Knipp. Divisional Interest: Arch. E., C. E., E. Draw. Math.

FULTON, ALBERT M., Coordinator of Curriculum Development, General Extension Division, University of Minnesota, Minneapolis. Divisional Interest: Admin.-Educ., English.

FUNCHESS, LINWOOD E., Associate Professor of Civil Engineering, Alabama Polytechnic Institute, Auburn, Ala. A. P. McDonald, L. B. Ryon.

GERDOM, HENRY FRED, Instructor in Engineering Graphics, Purdue University, West Lafayette, Ind. J. N. Arnold, J. H. Porsch. Divisional Interest: E. Draw., Shop and Mech. Arts.

GILBERT, NATHAN, Associate Professor of Chemcial Engineering, University of Cincinnati, Cincinnati, Ohio. W. E. Restemeyer, H. K. Justice. Divisional Interest: Chem. Eng., Math.

GLEASON, PAUL R., Professor and Chairman of Physics, Colgate University, Hamilton, New York. W. L. Everitt, W. L. Collins. Divisional Interest: Coordinators of Coop. Engrg., Physics.

GMEINER, PAUL, Program Manager, Engineering Training, International Business Machines Corporation, Rochester, Minnesota. R. J. Tritschler, D. B. Miller. Divisional Interest: Admin.-Ind., Electron.

HANNEMAN, DOUGLAS A., Instructor, Technical Institute Department, University of Dayton, Dayton, Ohio. J. L. McGraw, R. R. Hazen. Divisional Interest: E. E., Tech. Inst.

HELFFRICH, RANDOLPH G., Coordinator, Spring Garden Institute, Philadelphia, Pa. V. E. Neilly, R. E. McCord.

HENRY, LEVI L., Dean of Enginering, Detroit Institute of Technology, Detroit, Mich. A. C. deWilde, H. W. Nace. Divisional Interest: Eng., M. E.

HOLT, CHARLES A., Associate Professor of Electrical Engineering, Virginia Polytechnic Institute, Blacksburg. B. M. Widener, J. P. Gordon. Divisional Interest: Commun., Electron, Physics.

HYMAN, SEYMOUR C., Associate Professor of Chemical Engineering, City College of New York, New York, N. Y. A. X. Schmidt, H. S. Myers. Divisional Interest: Admin.-Educ., Chem. E.

KARARA, HOUSSAM M., Assistant Professor of Civil Engineering, University of Illinois, Urbana. M. O. Schmidt, W. H. Eldridge.

KHACHATURIAN, NARBEY, Assistant Professor of Civil Engineering, University of Illinois, Urbana. T. C. Shedd, E. J. Daily.

KNAUSS, HAROLD P., Head, Department of Physics, University of Connecticut, Storrs. W. L. Everitt, W. L. Collins. Divisional Interest: Physics.

LISTON, HARDY, JR., Assistant Professor of Mechanical Engineering, Agricultural and Technical College of North Carolina, Greensboro. J. M. Marteena, A. Richardson.

MACDONALD, GILBERT G., Dean of Students, Northeastern University, Boston 15, Mass. W. T. Alexander, H. W. Melvin.

MENSENDICK, CARL I., Assistant to the Dean of Engineering, Michigan State University, East Lansing. J. D. Ryder, J. W. Hoffman. Divisional Interest: Admin.-Educ.

MURRAY, ROY H., Associate Professor of Aeronautical Engineering, University of Cincinnati, Cincinnati, Ohio. W. E. Restemeyer, H. K. Justice. Divisional Interest: Aero. and Aero. Engr., Math.

MURPHY, ARTHUR, Coordinator, College Relations and Recruiting, Crucible Steel Co. of America, Henry W. Oliver Building, Pittsburgh 30, Pa. W. L. Everitt, W. L. Collins. Divisional Interest: College Relations.

OCKER, EDWARD H., Industrial Relations Officer, Naval Air Test Center, Patuxent River, Md. D. C. Hunt, S. J. Hirschfield. Divisional Interest: Ind.-Relations, Aero. and Aero. Engr.

REED, ARTHUR L., Director, Industry-Education Relations, Minneapolis-Honeywell Regulator Company, 2753 4th Avenue, South, Minneapolis, Minn. R. L. Goetzonberger, R. C. Jordan. Divisional Interest: Educ. Relations, English.

SCHWARZ, FRED CHARLES, Eastern Representative, Industry-College Relations,

Minneapolis-Honeywell Regulator Company, Wayne and Windrim Avenues, Philadelphia 44, Pa. R. L. Goetzenberger, R. C. Jordan. Divisional Interest: Admin.-Ind., Human.-Soc. Stud.

SMITH, V. MARLIN, Director of Division of Technology, Hampton Institute, Hampton, Va. W. S. Hill, T. N. Trolsen.

SPIVEY, ERNEST C., Co-op Coordinator, Army Ballistic Missile Agency, Huntsville, Ala. W. H. Merchant, J. G. Wohlford.

STREET, JULIAN, JR., Staff Director, Educational Aids and Technical Public Relations, United States Steel Corporation, 71 Broadway, New York 6, N. Y. J. L. Young, W. P. Jones. Divisional Interest: All types of informational activities on steelmaking for schools and colleges.

TORGERSEN, PAUL E., Instructor in Industrial Engineering, Ohio State University, Columbus. P. L. Lehoczky, W. T. Morris. Divisional Interest: I. E.

TRENDENNICK, DONALD C., Instructor Engineering Extension, Pennsylvania State University, University Park. K. L. Holderman, K. Hunter. Divisional Interest: E. Draw.

VALLENDER, STANLEY C., Personnel Manager, Minneapolis-Honeywell Regulator Company, Monrovia, Calif. R. L. Goetzenberger, R. B. Jordan.

WALSH, JOHN B., Assistant Professor of Electrical Engineering, Columbia University, New York, New York. J. R. Ragazzini, S. P. Schlesinger. Divisional Interest: Commun., Electron.

WELLER, RICHARD I., Chairman, Department of Physics, Franklin and Marshall College, Lancaster, Pennsylvania. M. R. Weller, H. Hunter Smith. Divisional Interest: Admin., Physics; E. E.; Physics.

WOLFE, JOHN K., Manager, Advanced Degree Personnel, General Electric Company, Schenectady, New York. M. M. Boring, W. S. Hill.

As of August 14, 1957

ASHERMAN, GEORGE, Associate Professor of Industrial Administration, University of Connecticut, Storrs. Charles W. Lytle, Richard H. Crompton.

BEAMESDERFER, JOHN WILLIAM, Professor and Head of Chemistry, University of Maine, Orono. Harry D. Watson, Matthew McNeary. Administrator, Educational; Chem.

BLANCHARD, RICHARD D., Director of Public Relations, Newark College of Engineering, Newark, N. J. Dr. Frank H. Lewis, Robert Kiehl. Divisional Interests: Public Relations; English.

BLUM, HAROLD ARTHUR, Associate Professor of Mechanical Engineering, Southern Methodist University, Dallas 5, Tex. John A. Savage, Sophus Thompson.

BOYD, JAMES EMORY, Director, Engineering Experiment Station, Georgia Institute of Technology, Atlanta. Paul Weber, R. L. Sweigert. Divisional Interests: Admin.-Educ.; Research; Physics; Gen. Eng.

BURCKEL, CHRISTIAN E., Publisher, The College Blue Book, 35 Washington Street, Yonkers, N. Y. Marshall L. Miller, H. C. Messinger. Divisional Interests: Coordinators of Cooperative Engineering.

CROWELL, WALTER S., JR., Coordinator of Personnel Procurement, Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. W. Leighton Collins, W. L. Everitt. Divisional Interests: Admin.-Ind., Personnel.

DELCAMP, ROBERT MITCHELL, Associate Professor of Chemical Engineering, University of Cincinnati, Cincinnati 21, Ohio. William Licht, Howard K. Justice. Divisional Interests: Chem. Eng.; Chem.

DOWNEY, ANTHONY E., Staff Administrator of Education, American Society of Tool Engineers, Detroit, Mich. Frederick Preator, Richard J. Bacik. Divisional Interests: Admin.-Educ.; Admin.-Ind., Tool Eng.

DUDEK, RICHARD A., Associate Professor of Industrial Engineering, University

of Pittsburgh, Pittsburgh, Pa. A. G. Holzman, E. A. DeLeo. Divisional Interests: Eng. Economy; Ind. Eng.

FAULDERS, CHARLES RAYMOND, Supervisor of Advanced Thermodynamics, Missile Development Division, North American Aviation, Fullerton, California. Harold W. Iversen, Paul B. Stewart. Divisional Interests: Aeronautics and Aeronautical Eng.; M. E.

FELDMAN, WALTER, Sales Engineer, Department of Education, Charvoz-Roos Corporation, Clifton, New Jersey. R. H. Siegfried, Earl D. Black. Divisional Interests: Eng. Draw.; Tech. Inst.

GARZATAMEZ, FEDERICO, Director of Civil Engineering School, University of Nuevo Leon, Monterrey, N. L., Mexico. W. Leighton Collins, S. H. Pierce.

GORMAN, MARION JOSEPH, Instructor, Central Technical Institute, Shawnee, Kans. N. E. Vilander, M. W. Van Dyke.

HAMMOND, WILLIAM MARION, Instructor of Electrical Engineering, Bradley University, Peoria, Ill. R. E. Gibbs, Philip Weinberg.

HOYT, HOWARD C., Personnel Representative of Engineering Department, E. I. du Pont de Nemours and Company, Newark, N. J. Marshall L. Miller, J. B. Moulton. Divisional Interests: Admin.-Ind.; Ind. Eng.

JOHNSON, PHILIP GORDON, Instructor in Physics, Wentworth Institute, Milton, Mass. H. Russell Beatty, Franklin H. Linton.

KILBOURNE, LEE E., Coordinator of Engineering Cooperative Education For Navy Activity, Industrial Relations Department, 3400, Great Lakes, Ill. R. G. Owens. Divisional Interests: Coordinators of Cooperative Engineering; Humanistic-Social Studies, Psych.

KIRWIN, GERALD JAMES, Assistant Professor of Electrical Engineering, Merrimack College, North Andover, Mass. Gordon S. Brown, Carlton E. Tucker. Divisional Interests: Math.; E. E.

KLEIS, ROBERT WILLIAM, Head of Agricultural Engineering, University of Massachusetts, Amhert, Mass. I. J. Pflug, C. J. Mackson.

MCEVOY, JOHN KERFOOT, Supervisor of Education and Training, A. C. Spark Plug Division of General Motors Corporation, Flint, Mich. Clyde L. Fanning, Charles L. Tutt, Jr. Divisional Interests: Admin.-Ind. Management Training; Coordinators of Cooperative Engineering.

MACKIE, SARAH PALMER, Instructor in Drafting, Central Technical Institute, Kansas City, Mo. N. E. Vilander, Merrill W. Van Dyke.

MANNIX, FRANCIS L., Personnel Manager of Personnel Department, Boston Division, Mineapolis-Honeywell Regulator Company, Farmingham, Mass. R. L. Goetzenberger, A. L. Reed. Divisional Interests: Admin.-Ind., Personnel.

MANZO, JOSEPH, Instructor in Electronics, Academy of Aeronautics, P. O. Box 1y6, New York 53, New York. Charles Hestin Coder, Jr., Robert J. Wear.

MARSH, WILLIAM HARRY, Dean, Keegan Technical Institute, Memphis 5, Tenn. Frank J. Keegan, J. B. Harrison. Divisional Interests: Admin.-Educ.; Tech. Inst.

MATTHEWS, EDGAR WESLEY, JR., Associate Professor of Electrical Engineering, Rensselaer Polytechnic Institute, Troy, N. Y. Frederick J. Norvik, Harold N. Trevett. Divisional Interests: E. E., Communications; Physics.

MEADE, RAYMOND DONALD, Coordinator of Cooperative Education, Illinois Institute of Technology, Chicago. Ralph G. Owens, Stanton E. Winston. Divisional Interests: Coordinators of Cooperative Engineering.

MILLER, JAMES ALFRED, Supervisor of Technical Training, North Carolina Laboratories, Bell Telephone Laboratories, Inc., Winston-Salem. F. Robert Michael, E. J. Thielen. Divisional Interests: Admin.-Ind., Tech. Training; M. E.

MILLER, WILLIAM RALPH, Assistant Professor of Mechanical Engineering, Case Institute of Technology, Cleveland, Ohio. D. K. Wright, Jr., E. Laitala. Divisional Interests: M. E.

MOLBY, LOWELL H., Instructor, Central Technical Institute, Olathe, Kan. N. E. Vilander, M. W. Van Dyke.

NEECE, LOUIS THOMAS, Director of Communications Engineering, Keegan Technical Institute, Memphis, Tenn. Frank J. Keegan, J. B. Harrison. Divisional Interests: E. E., Communications; Tech. Inst.

OLISZEWSKI, CASIMIR, Assistant Professor of Engineering Science, Portland State College, Portland, Oregon. O. N. Olson, J. E. Schoen.

PECSOK, JAMES D., Technical Personnel Manager, Reynolds Metals Company, Richmond, Va. R. A. Emerson, J. B. Moulton. Divisional Interests: Admin.-Ind., Tech. Personnel; Humanistic Social Studies, Psych.

PILKEY, ORRIN HENDREN, Manager of Design Engineering, Construction Engineering Operation, General Electric Company, Richland, Wash. R. E. Curtis, D. W. McLenegan.

POE, HERBERT VERNON, Associate Professor of Electrical Engineering. Clemson Agricultural College, Clemson, S. C. Walter L. Ball, James N. Thurston.

PROBST, GEORGE EDGAR, Executive Director of Thomas Alva Edison Foundation, New York, N. Y. Marshall L. Miller, W. Leighton Collins. Divisional Interests: Admin.-Educ.; Humanistic-Social Studies: Economics; History.

REMMERS, WALTER EDWARD, Vice President, Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. Curtis L. Wilson, V. A. C. Gevecker. Divisional Interests: Admin.-Ind.; Chem. Eng.; Chem.; Gen. Eng.; Ind. Eng.; Mech. Eng.; Min. Tech.

ROYS, CARL SHERWOOD, Professor and Head of Electrical Engineering, University of Massachusetts, Amherst. E. E. Lindsey, G. A. Martson. Divisional Interests: Admin.-Educ.; E. E.

RUDDOCK, BENJAMIN JAMES, Heat Transfer Department of Science, General Motors Institute, Flint 3, Mich. Earl D. Black, L. B. Wocholski. Divisional Interests: M. E.; Physics.

SHELEY, B. LEROY, Acting Dean, College of Industrial Technology, Boston University, Boston, Mass. W. T. Alexander, W. Leighton Collins. Divisional Interests: Admin.-Educ.; Aeronautics and Aeronautical Eng.

STEWART, NATHANIEL, Staff Advisor of Engineering Education, Department of the Navy, Arlington, Va. Keith Harder, Henry H. Armsby. Divisional Interests: Admin.-Educ.; Cooperative; Humanistic-Social Studies.

SWEDLOW, JEROLD L., Development Engineer, Advanced Engineering Department, Ingersoll-Rand Company, Phillipsburg, N. J. F. C. Lindvall, Donald S. Clark.

TAYLOR, JOHN GROVER, JR., Assistant Professor of Drawing, Mississippi State College, State College. H. P. Neal, William H. Eubanks.

TREVINO, ROBERTO, Rector, University of Nuevo Leon, Monterrey, N. L., Mexico. W. Leighton Collins, S. H. Pierce. Divisional Interests: Admin.-Educ.; C. E. Math.

WALTON, HAROLD V., Associate Professor of Agricultural Engineering, Pennsylvania State University, State College, Pa. Earl A. Myers, Elwood E. Olver. Divisional Interests: Agr. Eng.

WEBB, HAROLD WILLIAM, Head of Plumbing, Heating, and Refrigeration Department, Tuskegee Institute, Tuskegee, Ala. Jefferson D. Davis, Jr., W. Leighton Collins.

WINSTON, JOSEPH, Assistant Professor of Electrical Engineering, Newark College of Engineering, Newark, N. J. S. Fishman, F. A. Russell. Divisional Interests: E. E., Control, Power.

WORLEY, WILLARD PARKER, Instructor in Electrical Engineering, A. & M. College of Texas, College Station, Tex. R. L. Leutzinger, E. H. Andrew, Jr.

YARNALL, JAMES B., Assistant to the Vice President for Engineering Affairs, University of Pennsylvania, Philadelphia 4. C. C. Chamber, S. R. Warren, Jr.

ZUCKER, ROBERT DIEFENDORF, Assistant Professor of Mechanical Engineering, University of Louisville, Louisville, Ky. Carl O. G. Wittig, Frank Ryerson. Divisional Interests: Aeronautics and Aeronautical Eng.; M. E.

100 new members this year

OFFICERS OF SECTIONS, 1957-1958

(*Continued from page 122*)

Editor: W. H. Cook, Loyola University of Los Angeles
YET Repr.: J. S. Campbell, University of California, Berkeley
Physics Liaison: J. H. Wayland, California Institute of Technology
RWI liaison: Morris Feigen, Hughes Aircraft Co.
Vice Chairman: Affairs and Meetings: C. H. Cehrs, Fresno State College
Vice Chairman: Projects and Studies: J. B. Franzini, Stanford University

ROCKY MOUNTAIN:
Chairman: Frank Campbell, Colorado School of Mines
Secretary: Scott Marshall, Colorado State University
YET Repr.: D. Zwiep, Colorado State University
Council Repr.: W. M. Richtmann, Colorado School of Mines

SOUTHEASTERN:
Chairman: L. H. Johnson, Tulane University, New Orleans, La.
Secretary-Treas.: L. E. Schoonmaker, University of Florida
Council Repr.: D. W. Dutton, Georgia Institute of Technology
YET Repr.: J. C. Von Kaenel, Clemson College
Administrative Division
Chairman: W. J. Seeley, Duke University
Vice Chairman: A. T. Granger, University of Tennessee
Secretary: R. L. Sweigert, Georgia Institute of Technology
Instructional Division
Chairman: J. A. Bennett, University of Alabama
Vice Chairman: B. L. Baker, University of South Carolina
Secretary: E. K. Kraybill, Duke University
Research Division
Chairman: Jeff Coates, Louisiana State University
Vice Chairman: R. G. Sturm, Alabama Polytechnic Institute
Secy-Treas.: M. H. Chetrick, University of Louisville
Liaison With
English: J. H. Gardner
Humanistic-Social: G. A. Gullette, North Carolina State College
Mathematics: M. W. Aylor, University of Virginia
Graduate Studies: B. J. Covington, Louisiana State University
Coop. Engr. Educ.: S. E. Fisher, University of Louisville
Educational Methods: H. A. Romanowitz, University of Kentucky

SOUTHWEST:
Chairman: A. R. Burgess, Texas A. & M. College
Vice Chairman: I. W. Santry, Southern Methodist University
Secretary: Jack Lenhart, University of Texas
Council Repr.: V. L. Doughtie, University of Texas
YET Repr.: B. H. Amstead, University of Texas
Physics Liaison: H. E. Harrington, Oklahoma State University
RWI Liaison: R. M. Matsorb, Southern Methodist University
Exec. Comm.: A. R. Burgess, I. W. Santry, Jack Lenhart, V. L. Doughtie

UPPER NEW YORK-ONTARIO:
Chairman: T. R. Faucett, University of Rochester
Vice Chairman: G. F. Tracy, University of Toronto
Secretary: C. H. Dawson, University of Rochester
Repr.: R. N. Campbell, Alfred University

. . . . . YET-ITUDES

VIEWS AND NEWS CONTRIBUTED BY

The Young Engineering Teachers

HAROLD A. FOECKE, Chairman
Notre Dame University

ROBERT D. LARUE, Editor
Colorado State University

THE YEAR OF CHALLENGE

HAROLD A. FOECKE

At the 65th Annual Meeting at Cornell, the officers of the Society decided that, on a trial basis for this year, beginning with the first issue of the volume, copies of the JOURNAL would be made available to undergraduate engineering students at a much reduced rate. For this reason, this is perhaps an historic volume for the JOURNAL.

The writer deems it a privilege to address some of these lines directly to this new group of readers. To do so constitutes a departure from the traditional function of the first YET-itude of each new academic session, which has formerly been to give the incoming chairman of the Committee for Young Engineering Teachers an opportunity to very briefly outline the program of YET activities for the coming year. By contrast, these lines are directed not only to the present young engineering teachers, but also to the *prospective* teachers, our engineering students.

To Engineering Students

If you are an engineering student reading these lines, you are probably doing so as a result of initiative on the part of one of your teachers, for heretofore very few students have been aware of either the JOURNAL or the ASEE which it represents. It may be hoped that this condition will soon be a thing of the past.

One of the principal reasons for bringing this JOURNAL to your attention is simply that from among your ranks will come the engineering educators of tomorrow. The sooner you become acquainted with the problems of engineering education and with the vigorous discussions of these problems which are carried on in the JOURNAL and at ASEE meetings, the more surely will you be able to cope intelligently with the problems which you will inherit in just a matter of time. To be perfectly honest, the society hopes that, by giving you an opportunity, as students, to become familiar with the interesting challenges in the field of engineering education, more and more of you will decide to experiment with the possibility of making this field your life's work, and that more of you will identify yourselves as *prospective engineering teachers.*

For far too long the engineering schools and the ASEE have neglected to exploit thoroughly their four-year opportunity to interest you in a teaching career. The colleges have not been as active as they might in honestly explaining to you your opportunities in teaching, and have not

brought to your attention its unique advantages and disadvantages. In fact, you have seldom been counseled to the effect that, far beyond research, design, production, sales, etc., teaching is one of the best possible types of engineering work upon which you might embark after graduation.

It would not be profitable to waste time trying to find reasons for this seeming neglect of past opportunity. Suffice it to observe that the severe shortage of engineering teachers, bound to get much worse before it gets better, has helped to bring about this ASEE experiment. Interest in improving the morale of students and teachers alike has also stimulated us to seek ways and means of attracting brilliant and capable young men to engineering teaching as a career. The ASEE will be watching the results of this experiment with deep interest. Should the results be encouraging, perhaps the Society will find still other ways of recognizing, and discharging, its responsibility to prospective engineering teachers.

For instance, this writer has been a bystander at recent discussions in which some engineering teachers have proposed that there be established, for undergraduate students who have made a tentative decision to enter the teaching profession, the rank of student member of ASEE. The specialized professional societies corresponding to the different fields of engineering have long had student membership and student chapters (or branches) as a means of providing the student with a form of early professional identification. In this way, the societies also introduce the student to the traditions, activities, and problems of his future profession. So too, the argument proceeds, the ASEE should provide this early professional identification and aid the professional development of future engineering teachers. The ASEE, of course, represents all engineering fields.

Whether student membership is established, or whether completely different ideas develop, what matters most right now is the fact that explicit first steps are being taken to interest you and your fellow students in a career in engineering education. For the present, the JOURNAL is available to you. You will almost certainly find interesting and provocative articles in every issue which provide topics for discussion with interested fellow students or with your teachers that will be stimulating and rewarding. If you wish, you will doubtless be able to find a faculty member to sponsor occasional informal discussions of the ideas and questions generated by the JOURNAL. You can demonstrate your initiative and your ability by engaging in constructive discussion of engineering education. The profession awaits your dedicated service!

To the YETS

And now a few observations directed to the young engineering teachers who read these lines. From the foregoing paragraphs you have probably already sensed what a unique challenge presents itself to us. We have an opportunity to swell our ranks, for the good of engineering education and for our own good as well, for only an increase in our numbers can reduce the present excessive teaching loads.

If you have been following the

JOURNAL, you are already aware of the appointment last year of the top priority ASEE Committee on Development of Engineering Faculties (CDEF). This major committee was charged, among other things, with the task of studying the problem of recruiting and training college teachers of engineering. The committee has made it clear that it recognizes the unique contributions which our ASEE Committee for Young Engineering Teachers (CYET) can make to this study.

In the matter of recruiting, when a student considers entering teaching, to whom would he logically turn for counsel on the problems of entrance to the profession if not to us who have recently entered it ourselves? Furthermore, is it not also true that, on the average, we are more likely than our older colleagues to have the sort of intimate contact with undergraduates which permits us to spot outstanding students whose personalities and interests would seem to fit them for successful teaching careers? For all these reasons we would do well to exercise our ingenuity at our local institutions in finding ways of mobilizing the possible interests of our students in teaching careers.

In considering another aspect of the work of the CDEF, namely the training of college teachers of engineering, and developing them to full professional competence, we who are now in the midst of our own professional growth should be able to make significant contributions.

Other Activities

Among the other YET activities of the coming year in which you will have an opportunity to take an active part are the following:

1) The YET paper Contest will apparently be continued for another year. The number of papers submitted each year is still quite low, with some sections having no entries at all, but both the number and quality are rising. More participants are needed! The challenge is yours!

2) Because of the overwhelming enthusiasm of industrial companies for that service, our CYET will again collect the names of engineering teachers who seek summer employment this year, and make these names and background information available to interested companies. The local YET representative at your institution can provide forms to you for this purpose. If you cannot locate the YET representative in your area, write to the national CYET secretary, who will put you in touch with the right people at the local or sectional level. His address is: Professor C. J. Sperry; versity; New Orleans 18, Louisiana.

3) The Society's YET Summer Institute Committee is making gradual progress on plans for a summer school for young engineering teachers. The committee, whose names will be published in the JOURNAL, will probably call upon YET for assistance in ascertaining individual interests and needs in order to develop a summer program. This call for ideas offers a challenge we hope you will not let pass.

4) As in recent years, the Executive Board of ASEE has asked the CYET to conduct the membership campaign for the Society. Please give your local YET representative any assistance he may request in making the membership campaign at your school a real success.

Forward!

The above are the bulk of YET activities of a national scope for the coming year. Each year has found the Committee for Young Engineering Teachers a little more effective in being of service to young engineering teachers and to the Society. To be sure, each new year brings fresh challenges and opportunities. Perhaps one may be pardoned, however, for suggesting that the forthcoming year may be characterized as "the year of challenge," for many new opportunities are open to us to be of service to each other, to the rest of ASEE, and to the whole of engineering education. If we rise to these challenges, we can be assured that the demonstrated maturity of our relatively young committee will be a source of satisfaction to all within ASEE, especially to those officers of the Society who have so consistently and generously encouraged our growth and fostered our interests and activities.

TEACHING POSITIONS AVAILABLE

(Continued from p. 146)

MECHANICAL ENGINEERING FACulty needed for courses in thermodynamics, heat transfer, fluid mechanics, and laboratories. Also electrical engineering faculty needed qualified in power engineering, basically in the field of circuits. Someone in electronics could be used. Persons should have teaching and industrial experience. Salary and rank dependent upon degree and experience. Positions now open. Apply to Dr. Hildred B. Jones, Dean of University, Ohio Northern University, Ada, Ohio.

ELECTRICAL ENGINEERING OPENings are available in a recently authorized department. Rank, salary, and teaching opportunities are excellent. Positions are available beginning spring semester, 1958 and for 1958–59. Send resume of education and experience to Head of Electrical Engineering, Bradley University, Peoria, Illinois.

TWO AERONAUTICAL ENGINEERing staff positions. Senior professor to head up the work in aircraft structural mechanics. Prefer Ph. D. degree and considerable academic and/or industrial experience in aircraft dynamics. Emphasis will be placed on development of the graduate program and research in these areas. Also, assistant professor to teach undergraduate courses in aerodynamics, aircraft structural analysis and design. Master's degree or equivalent industrial experience preferred. Ample opportunity for research toward advanced degree. Rank and salary for both positions are dependent upon qualifications. Submit biographical outline, list of publications, and recent photograph to Dr. M. J. Thompson, Chairman of Aeronautical Engineering, University of Texas, Austin 12.

GRAPHIC SCIENCE

Analysis—Synthesis—Communication

Sponsored by the Engineering Drawing Division

Editor: Eugene G. Paré
Washington State College, Pullman

RESEARCH IN GRAPHICS

STEVEN ANSON COONS

Assistant Professor of Engineering Graphics
Massachusetts Institute of Technology

Condensation of talk presented at the Mid-winter Meeting of the Drawing Division, Houston, Texas, February 1, 1957.

A Graphical State of Mind

How can a graphics department best participate in research? Implied in my discussion is *research in graphics*. And, briefly, to best participate in research, one must first cultivate a graphical state of mind. It is not necessarily possessed even by those who make drawing their profession, and this is very curious.

I know an electrical engineer who is strongly imbued with it; he talks with pictures, sketches, curves, and diagrams. He writes an equation and immediately commences to describe its implications by means of drawings. He sees graphs instead of formulas, curves instead of algebraic symbols. Graphics is to him the very stuff of which his thoughts are made. He uses drawing as a means of communicating with himself, with his innermost consciousness, and of bringing forth vague notions and giving them concrete form. Much of the process of computation he carries on graphically.

But I also know many graphics people who do not think and feel in graphical terms at all. When faced with an unfamiliar problem they reach instinctively and automatically for algebraic and numerical tools. For instance, suppose you are asked to find the product function $P(x)$ of two given factor functions $f(x)$ and $g(x)$ in accordance with the formula

$$P(x) = f(x)\ g(x).$$

If $f(x)$ and $g(x)$ are given as two graphs, what do you immediately think to do? Would you scale off the values of $f(x)$ and $g(x)$ from the graphs, multiply these numbers and then plot the product points to define $P(x)$, or do you wonder whether there is not some simple graphical construction for the curve, a construction which doesn't involve arithmetic and numbers at all?

If you wonder, you have the graphical state of mind. And probably, having this attitude, you have already encountered a problem, asked yourself if it could be solved by purely graphical means, so solved it, and thus have participated in research.

Maximum-Minimum

At the 1956 meeting in Ames there was considerable discussion of a problem of maximum and minimum sum of face angles for the body diagonal of a parallelepiped. This discussion was entirely analytical and algebraic. Now if you are saying to yourself, "Problems of maxima and minima are intrinsically insoluble by purely graphical methods," you do not have the graphical state of mind I mentioned; what's more, in making such a sweeping statement, you are wrong. To show that you are wrong, I remind you of the familiar puzzle question of the shortest path from point A to line L to point B, as shown in Figure 1.

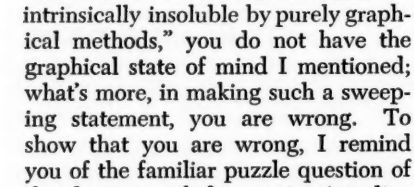

FIG. 1

This is clearly a minimal problem, and certainly the graphical solution is the most practical one, because it is so simple. Now if this problem can be solved by graphical means so easily, doesn't it make you wonder if the max-min problem might succumb too? And it isn't too rare that in the course of solution of such a special (and unimportant) problem, one discovers truths of far greater generality and wider usefulness, particularly if one is receptive and on the lookout for such generalities.

If you have the graphical attitude, if every new situation makes you automatically ask yourself how graphics can be applied, then you are already engaged in research. I shall call your attention to a few problems of interest and importance which I myself would like to investigate when I get around to it, and if any of them prove to be an inspiration and a challenge, please help yourself. There are plenty more.

Differential-Integral Equations

First, in partial differential equations, the familiar LaPlace equation is more or less readily solved by a purely graphical process even if the shape of the region is not simple. The process is called field mapping and is well known. There exist special methods, both numerical and graphical, for solution of a few other partial differential equations, like the Poisson equation. However, there exists no general technique for solution of all such equations. Quite general graphical methods exist for solution of ordinary differential equations. Can these methods be extended to partial differential equations? The applications are many; heat flow, fluid dynamics, vibrations of mechanical systems, stress analysis, electrostatic and magnetic fields are examples.

Another problem concerns integral equations, of which two important types are

$$\phi(x) = \int_a^b k(u, x)\, \phi(u) du$$

and

$$\phi(x) = \int_o^x k(u, x)\, \phi(u) du.$$

In these equations, $k(u,x)$ is a known function of the two variables, and is called the "kernel," while ϕ is an unknown function defined by the expression. The fact that ϕ appears under the integral sign as well as in the left-hand member is what makes these equations so difficult. It is easy to

perform a graphical integration, provided we know what we are integrating, but what do we do with this situation?

Euclidean Constructibility

We have all heard the statement, "It is impossible to trisect an angle," which is an inaccurate and misleading abbreviation of the more accurate statement "Many angles cannot be trisected, provided we restrict ourselves to constructions based on the use of a compass and an unmarked straight-edge." We need to say *many* because there is an infinite number of angles like 360°, 180°, 90°, 45°, etc. that can easily be trisected even under the given restrictions of means. On the other hand, if we allow only two marks on the straight-edge, thus removing one of the restrictions on means, we can indeed trisect any angle.

In a more general vein, suppose we have some geometrical problem, together with some graphical solution. The solution, let us say, involves constructing a number of points in accordance with the conditions of the problem, fairing a smooth curve through the points, and then finding the intersection of this curve with a line, a circle, or another curve similarly drawn.

Knowing this much, can we decide whether or not to bother to try to find a compass and straight-edge solution to this problem? If we could readily conclude, knowing the nature of the graphical solution, that a pure Euclidean construction was impossible, we would save much fruitless time and thought spent looking for it.

An example or two may make the point clear. We know that it is easy to draw the path of a ray of light from point A to reflection in a plane mirror to reception by the observer's eye at B, Figure 1 again.

This is a simple construction, entirely within the restrictions of Euclid. Now suppose the reflecting surface is a sphere, what then? Certainly this is possible by graphical means, but I do not know how to perform it by classical geometry, and I suspect on fairly convincing evidence that it cannot be done. Convincing evidence and mathematical certainty, however, are very different indeed.

We know that Euclidean constructions involve intersections of lines with lines, lines with circles, and circles with circles, possibly more than once, but involving nothing more than these operations. Now if we can show that because of suitable point transformations the curves of the graphical solution always go into circles and lines, then a Euclidean solution is possible. This seems simple enough—all we need to find out is what transformations are suitable. It really isn't simple at all, though, and it might be a most interesting and fruitful topic for research.

Subjective Questions

From the foregoing problems in pure mathematical graphics, I now turn to an entirely different sphere of study, a domain that I will call the "subjective questions" of graphics. For one such question, we might ask "What is the relationship between the actual drawing and its perception, or the information it conveys to the reader?" The drawing is after all only an implication; the reader is the one who draws the inference from it.

Now we know that the actual shape of a drawing and the information gained from it are sometimes very dif-

ferent. I remind you of several well-known optical illustions: the interrupted straight line which appears discontinuous, the line segment with distracting lines attached which make it appear longer or shorter than its actual length, the stairway which inverts, being either stairway seen from above or the underside of a stairway seen from below.

If such simple graphical situations lead to false or ambiguous interpretations, isn't it conceivable that there is much to learn in this connection? Perhaps we may never have suspected the ways in which these and other phenomena can be discovered, understood, and perhaps even put to use?

A perspective drawing is only an imperfect imitation of geometrical reality as we see it, partly because the drawing is a projection on a plane while our retinal image is on a curved surface, and partly because the mechanics of seeing involves motion of the eyeball, kinesthesis, and scanning, not entirely analogous to the action of a camera. But these are only imperfect hints as to the interesting field of drawing and its connection with perception.

If we understood more about the problem we would know how to make clearer illustrations for scientific and technical publications, illustrations that would more vividly portray the ideas involved, be better looking, and easier to reproduce by less expensive printing methods. Of course this is close to the domain of the artist, but it is still not quite aesthetics, and I think at least some work might well be done on the scientific side of the boundary.

In this same connection we might turn to the question of legibility of the traffic-directing signs on our highways. Already much has been done in the study of such things as letter shapes, sizes, marks such as arrows, color and color contrast, placement, and other factors. Extension of this seems to me to be a fruitful and important field for research, and who is more logically fitted for it than the graphics expert, working perhaps with the psychologist?

Again, how can drawings be improved as a means for conveying information about shape and size? That is, what can be done to drawings to make them legible even to the uninitiated? How readily can this increased legibility be achieved? As things are now, many drawings are as hard to read as a lease or the instructions on income tax forms.

If such pictures are so clear they're worth a thousand words, why is it so hard to understand them? The necessity for courses in blue print reading is almost absurd, when you come to think of it, because a drawing should be a picture, and who needs to learn how to see a picture?

Summary

To summarize my beliefs about graphics and its place in research: I think the prospective researcher must have a strong belief in the power of graphics; be willing to rush in where angels fear to tread; to be eager to try graphical techniques even when other possibly wiser people think they aren't applicable; have a nagging curiosity about technical matters in general; and possess an automatic, instinctive desire to fit all such technical matters into the frame of Graphics.

gibility of
our high-
been done
s as letter
as arrows,
placement,
ion of this
ul and im-
nd who is
than the
rhaps with

gs be im-
veying in-
ize? That
rawings to
o the un-
an this in-
eved? As
wings are
or the in-
orms.
ear they're
hy is it so
The neces-
nt reading
u come to
ing should
ds to learn

iefs about
research: I
rcher must
e power of
h in where
eager to try
when other
they aren't
g curiosity
n general;
instinctive
cal matters